SEMTech Solutions

SEM Interface
User's Manual

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Introduction

The SEM Interface software enables an SEM to be controlled using mouse driven buttons and controls. The user interface uses many standard Windows® controls and features that make it easy to use for anyone familiar with Windows® operating systems.

There are many multifunction controls that use a combination of left and right mouse clicks to make adjusting the SEM parameters fast and efficient. Analog controls use a combination of left right and center mouse clicks for fine medium and coarse adjustments. Digital controls use left and right mouse clicks to select quick presets or random input. Fully customizable quick presets allow customization of controls to a user's preference.

Status information is available in a variety of forms giving the user good feedback as to the current status of the SEM. Custom indicator buttons graphically display the amount of adjustment applied to a setting. Some buttons will be tinted blue to indicate that a particular mode or function is active. Radio buttons are used to show the current setting and enable the setting to be quickly changed. A status bar across the bottom of the form displays information about the current scan mode, the video input source, the last image saved and the current image size.

Use the measurement and annotation functions to add graphics and text to images. The measurement functions allow measurements to be made orthogonally, in any direction or can be used to measure angles. A feature of interest can be highlighted by drawing a box around it or adding arrows pointing to it. Text and symbols can be added to the image and then edited if necessary.

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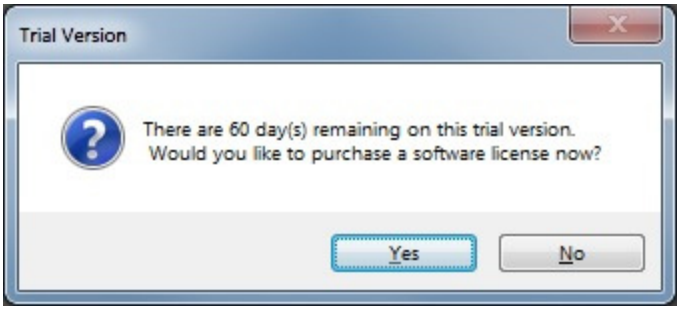
Chapter 1. Quick Start

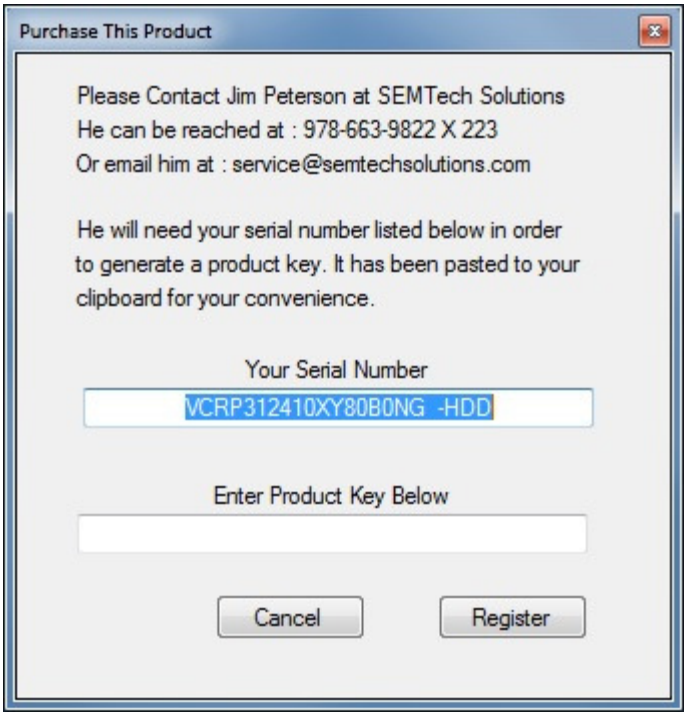
1.1 Getting Started

Set the Image Shift, Stigmator and Beam Alignment controls on the SEM electronics console front panel to the center of their range (the 12:00 O-Clock position).

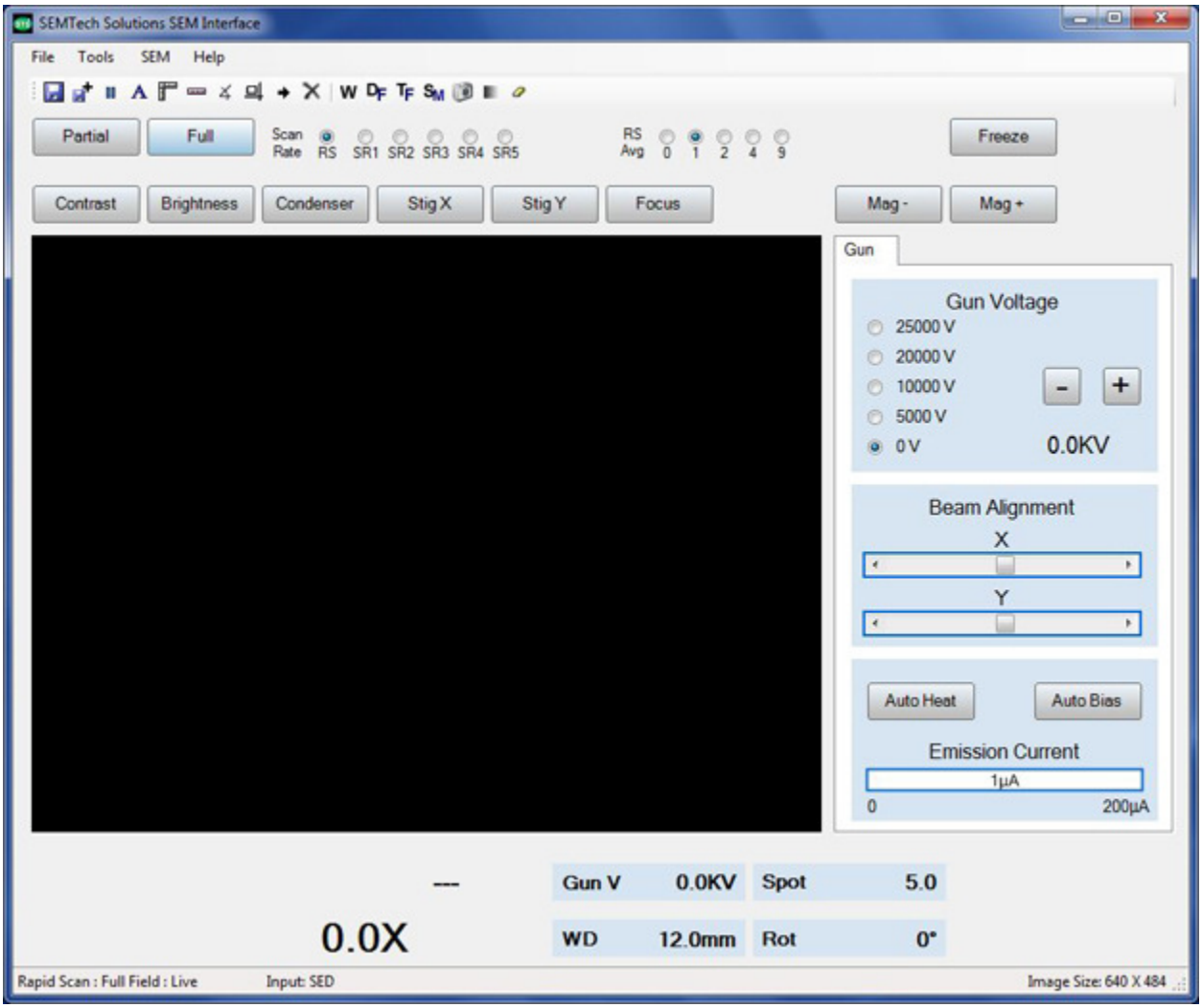
Double click the SEM Interface Icon on the desktop. If the trial version of the software is being used, a window will appear telling the operator how many days are left before the trial expires. If the customer has purchased a software license the window will not appear.



Clicking yes will open the dialog shown below. The serial number will be automatically be pasted to the Windows® clipboard. Email or call the contact listed and provide Your Serial Number. A product key will be generated and provided to you. Enter it into the Enter Product Key Below text box and click the Register button.


Purchase This Product
Please Contact Jim Peterson at SEMTech Solutions
He can be reached at : 978-663-9822 X 223
Or email him at : service@semtechsolutions.com
He will need your serial number listed below in order to generate a product key. It has been pasted to your clipboard for your convenience.
Your Serial Number
VCRP312410XY80B0NG -HDD
Enter Product Key Below
Cancel
Register

Once the software opens, a window will appear that looks similar to the one below. This window is configurable and is setup by a SEMTech Solutions service engineer during installation.



This particular version is for an 1830 with all the wiring modifications performed. The wiring modifications will be completed if a software license has been purchased.

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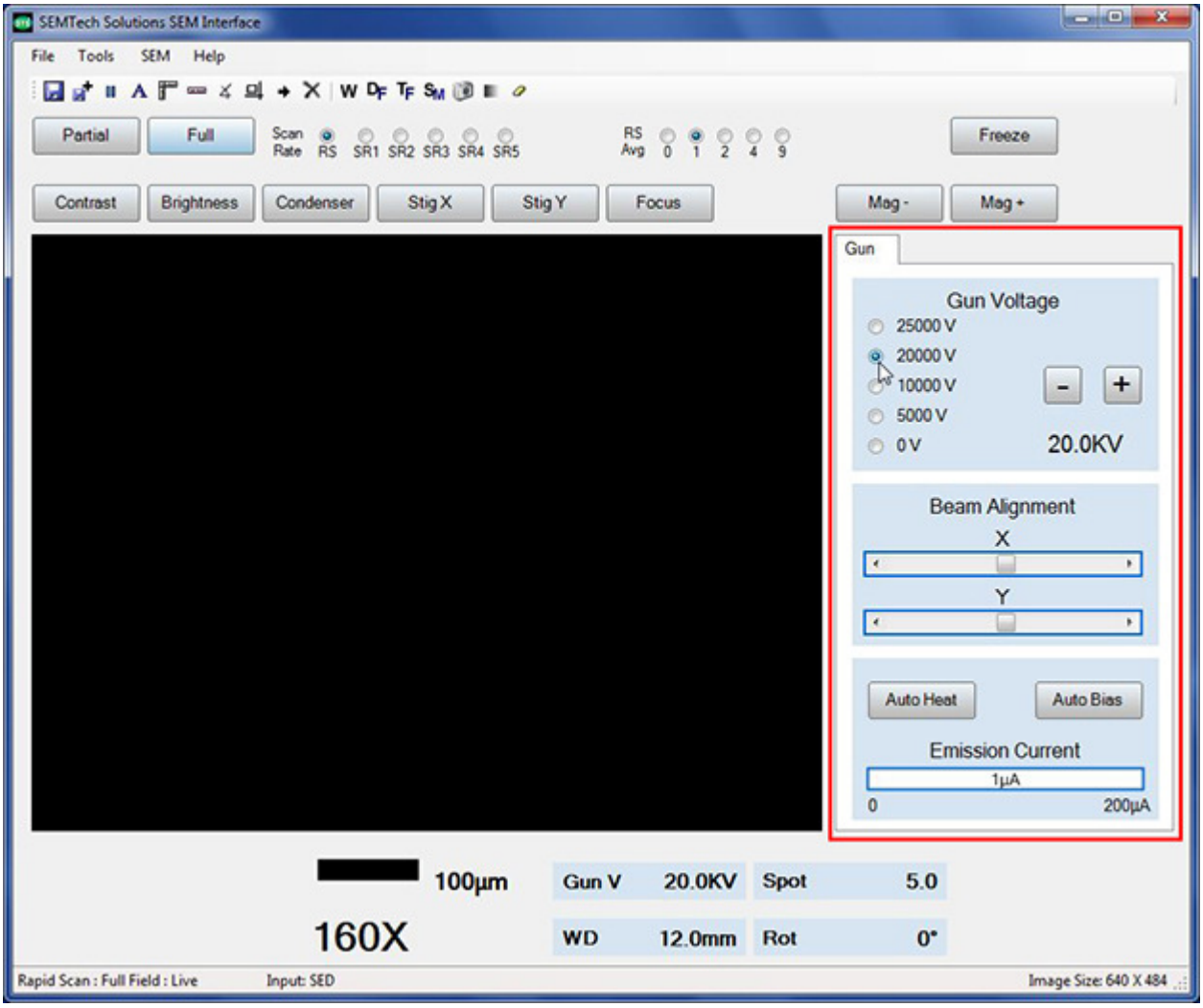
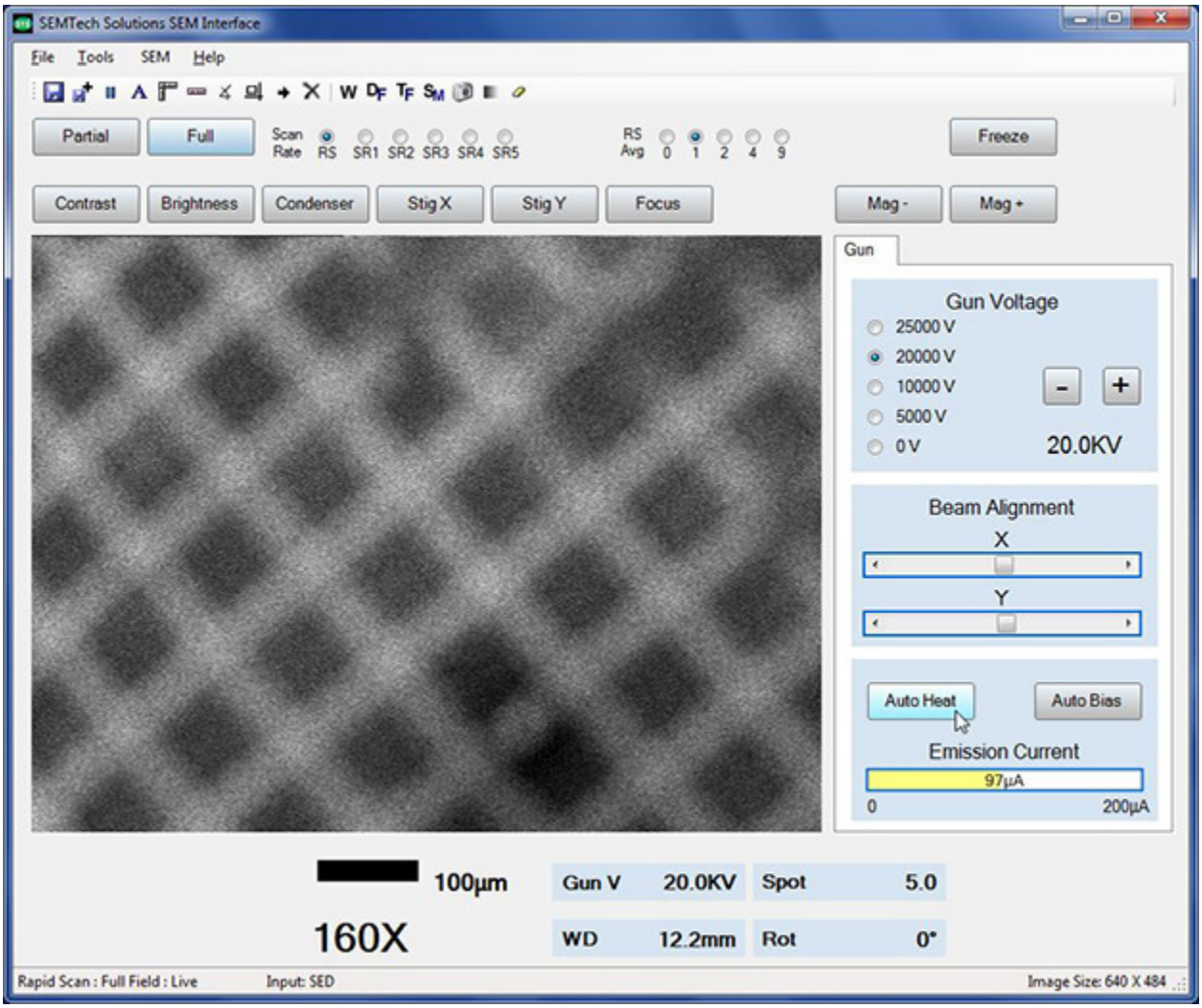
Turn on the Gun Voltage. Use the radio buttons located on the Gun tab to select the desired gun voltage. The tab pane is located on the right side of the window. Depending on the system configuration more tabs may be present in the tab pane.



Click the Auto Heat button located on the Gun tab. The button will flash while the filament current is ramping up to its set point. It will stop flashing and be tinted blue when the filament current is at the set point. The Emission Current will increase as the filament heats up. The image may come up out of focus.

Note: The Beam Alignment section and the Emission Current meter located on the Gun tab will only be present when the wiring modifications have be performed after a software license has been purchased.

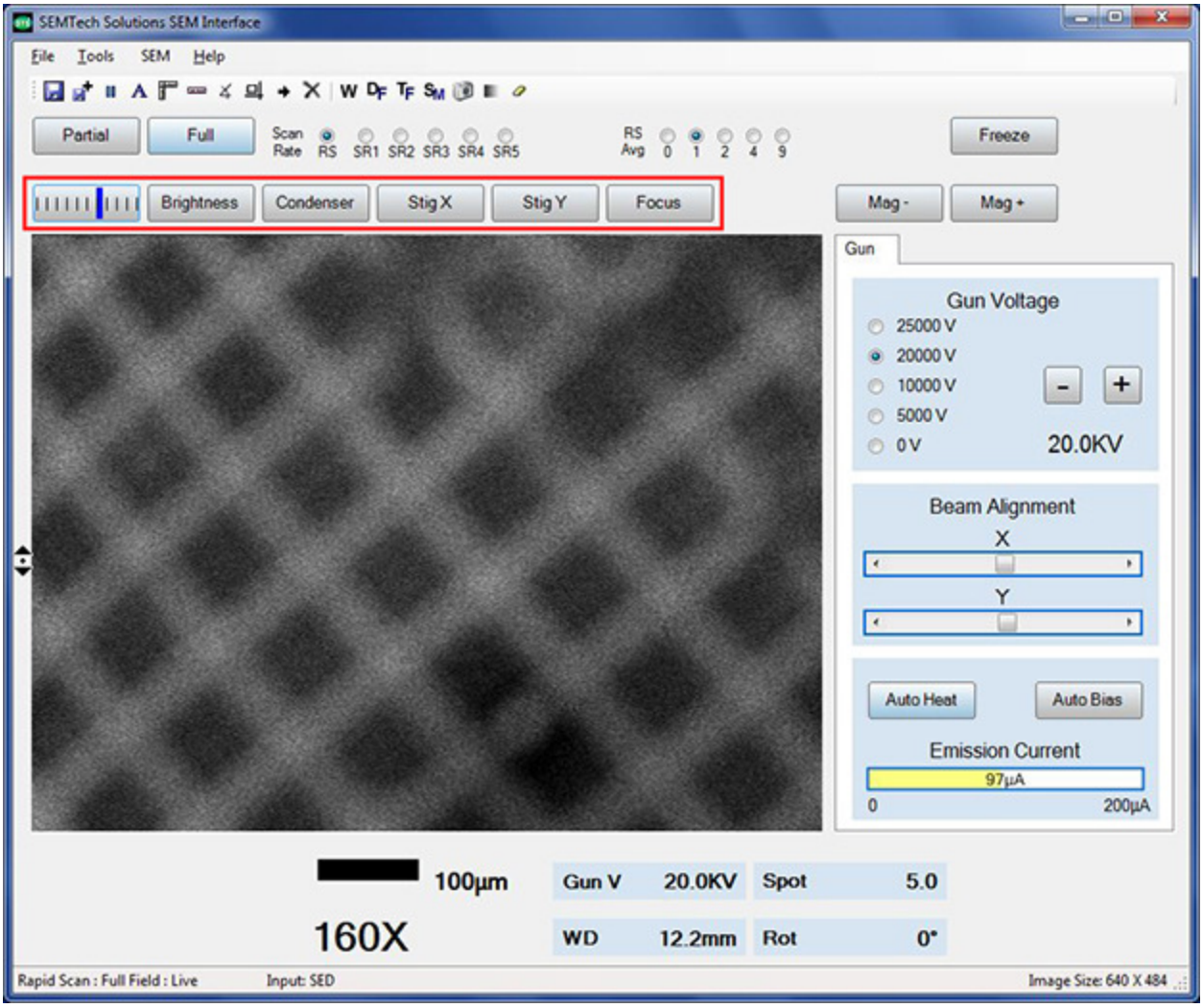


1.2 Image Adjustment

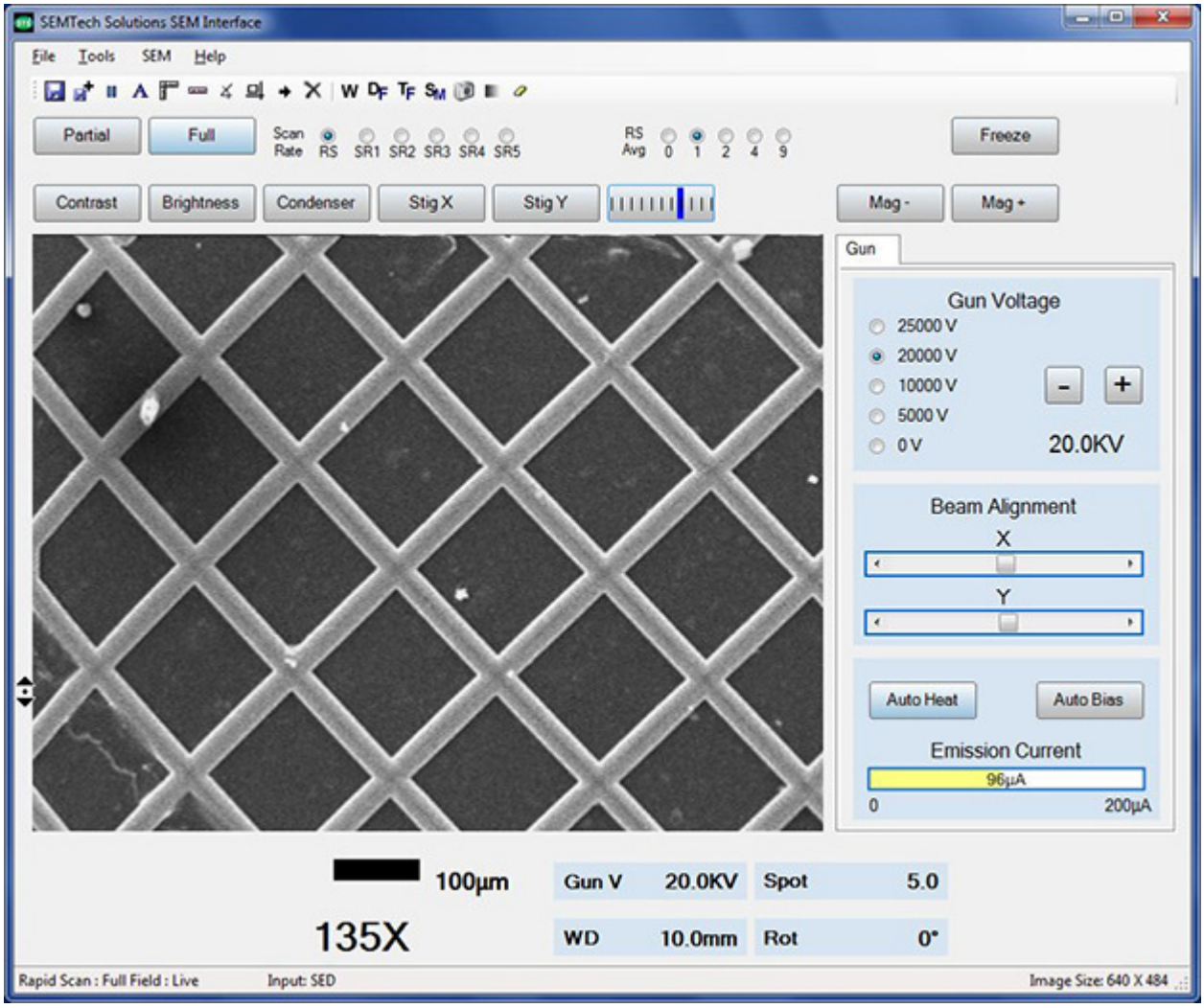
The buttons outlined below in red are used to adjust the image. They all use the same click and drag function to adjust the image. The left mouse button is used for fine adjustment, the right mouse button applies a coarse adjustment and the middle mouse button is an extra coarse adjustment.

Right click and hold the mouse button down on the desired image adjustment button. Another cursor will appear on the left side of the image. By dragging the mouse up or down it will apply a coarse adjustment.

In this case, the contrast is being adjusted. The button face changes to an indicator gage when a button is clicked. The blue line in the indicator gage shows how much adjustment has been applied. The black cursor on the left side of the image will move up and down with the mouse movement.

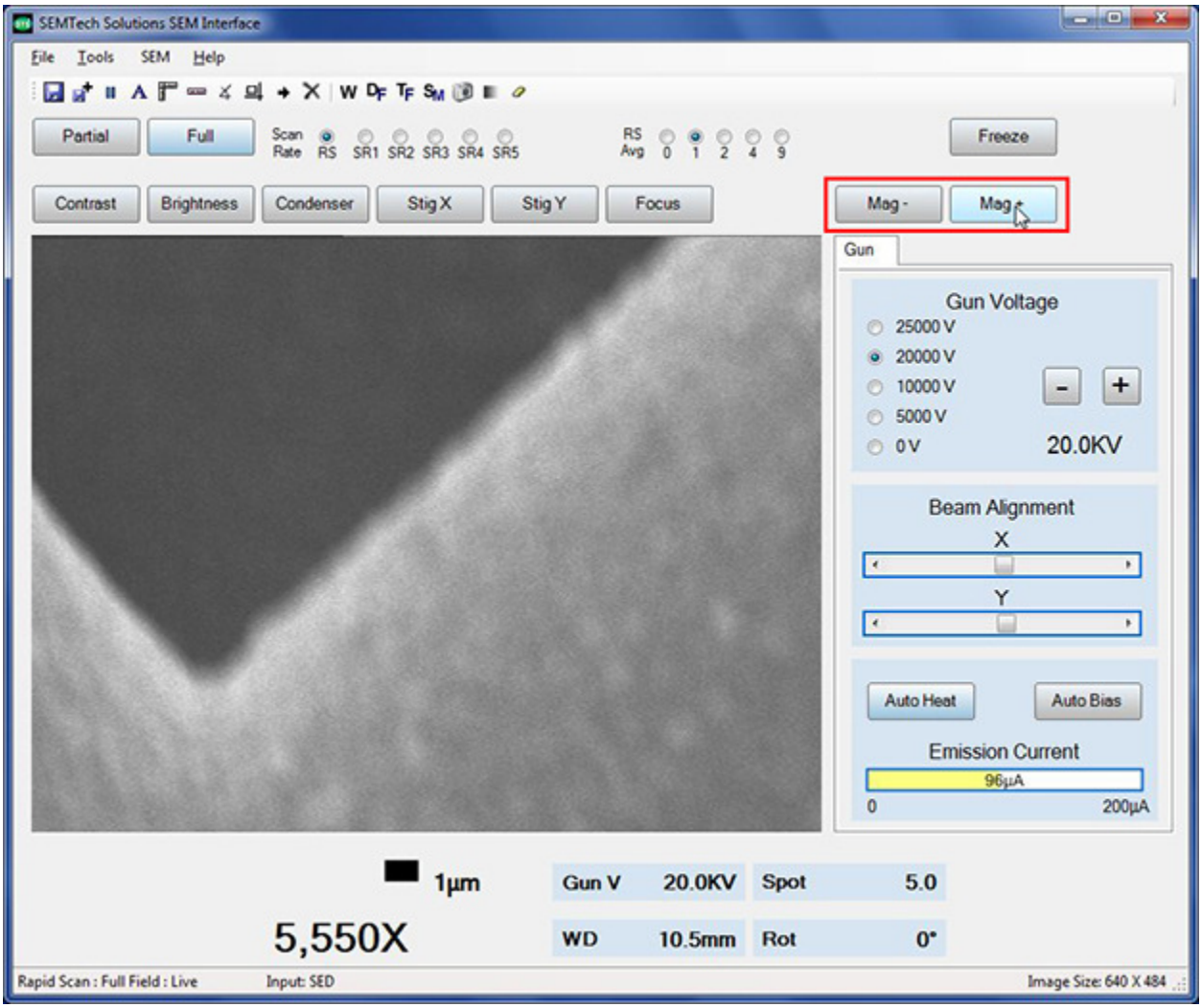


Coarse focus the image by right clicking and holding the mouse button down on the focus button. Drag the mouse up and down to focus the image.

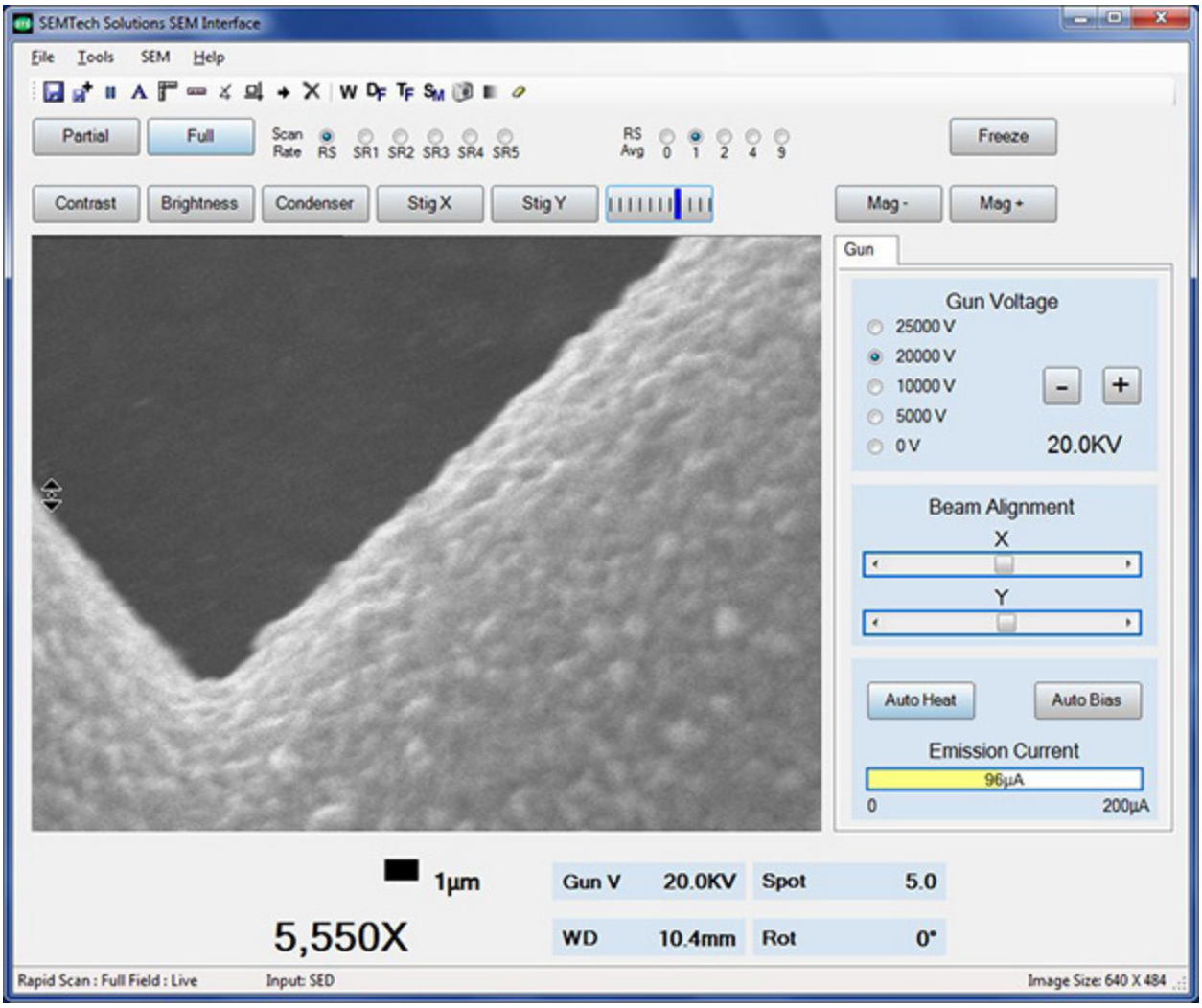


The buttons outlined in red below are used to adjust the magnification. The left mouse button is a slow zoom, the right mouse button is a fast zoom and the middle button zooms by a factor of 10. The mouse buttons may be clicked and released to apply a small change or they can be clicked and held to apply a continuous zoom. The Mag + button increases the magnification and the Mag - button decreases the magnification.

Right click on the Mag + button to increase the magnification.



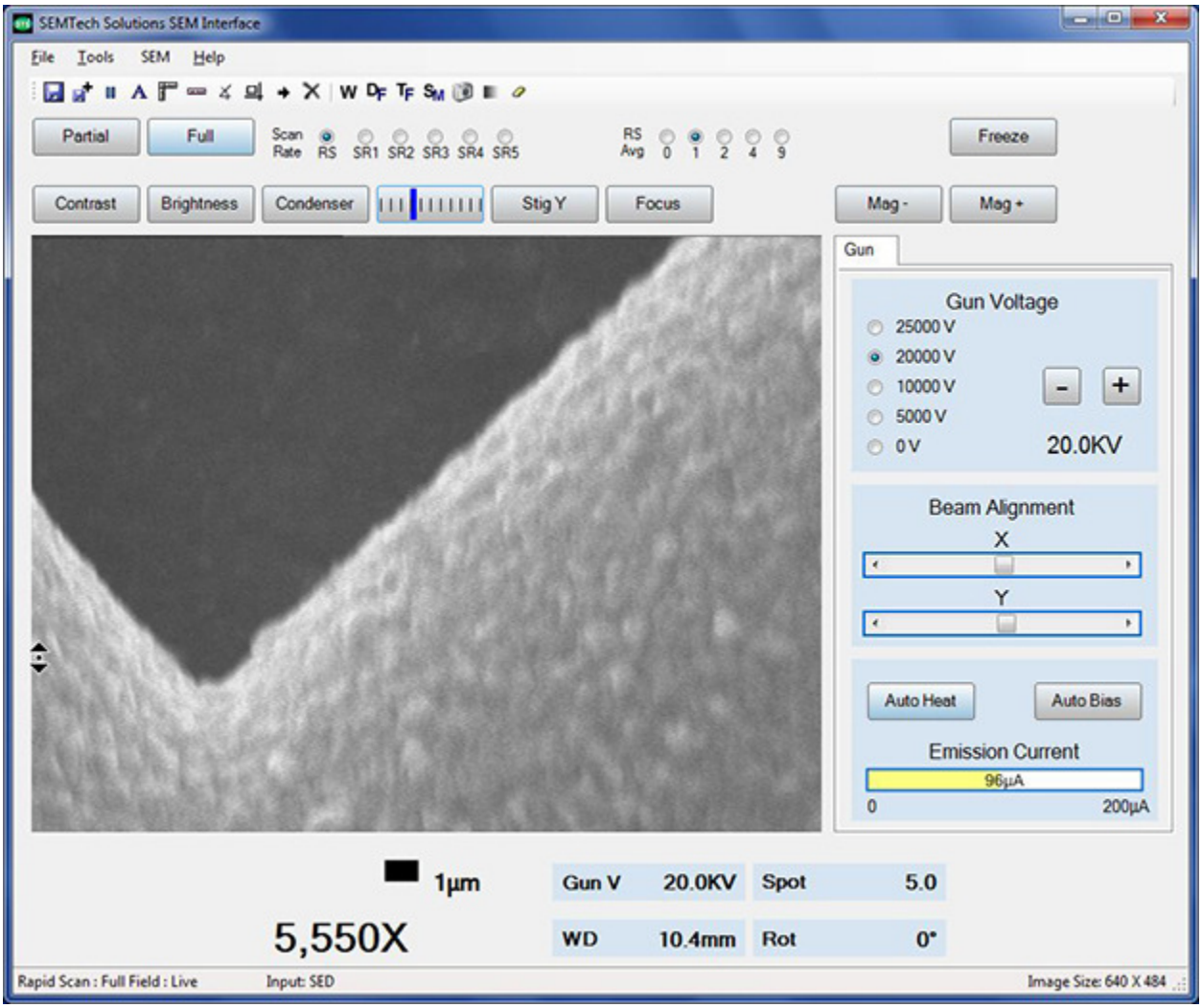
Refocus the image at the higher magnification. Left click on the focus button and drag the mouse up and down to apply a fine focus to the image.



Once the image has been focused it is time to stigmate the image. This is done by right clicking and holding the Stig X button. Drag the mouse up and down to optimize the image.

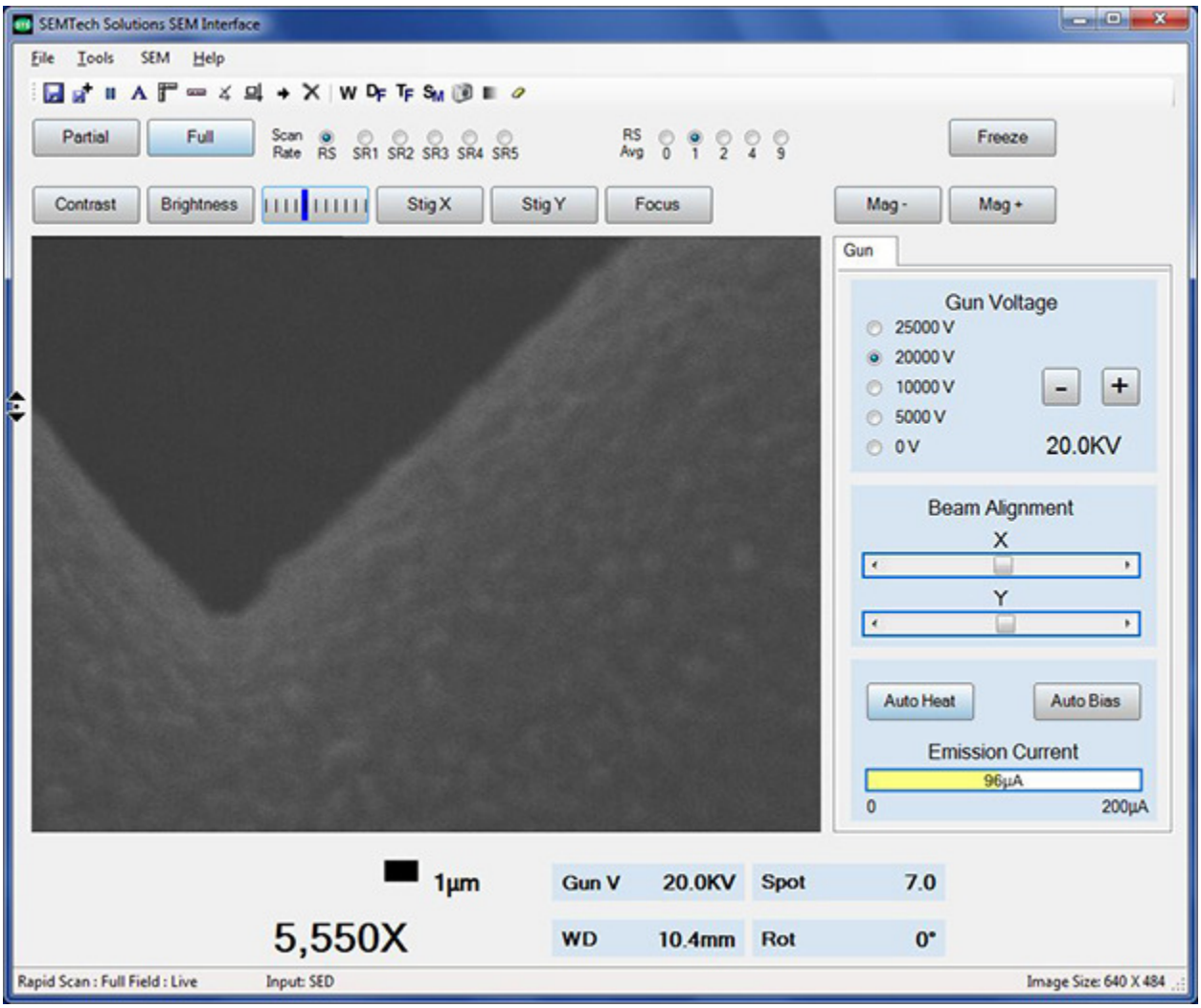
Once the X adjustment has been made right click and hold the Stig Y button. Drag the mouse up and down to optimize the image.

Note: It is important that the stigmator controls on the SEM console front panel are at the center of their range (the 12:00 O-Clock position) so that the maximum range of adjustment can be applied by the SEM Interface software.



The Condenser button controls the Spot Size. The higher the spot size number the smaller the beam diameter. A smaller beam diameter will give a better image resolution.

Right click on the Condenser button and drag the mouse up to increase the spot size. An increase in spot size will cause the signal to drop and the focus to change. Readjust the image quality again using the Contrast, Brightness and Focus controls.

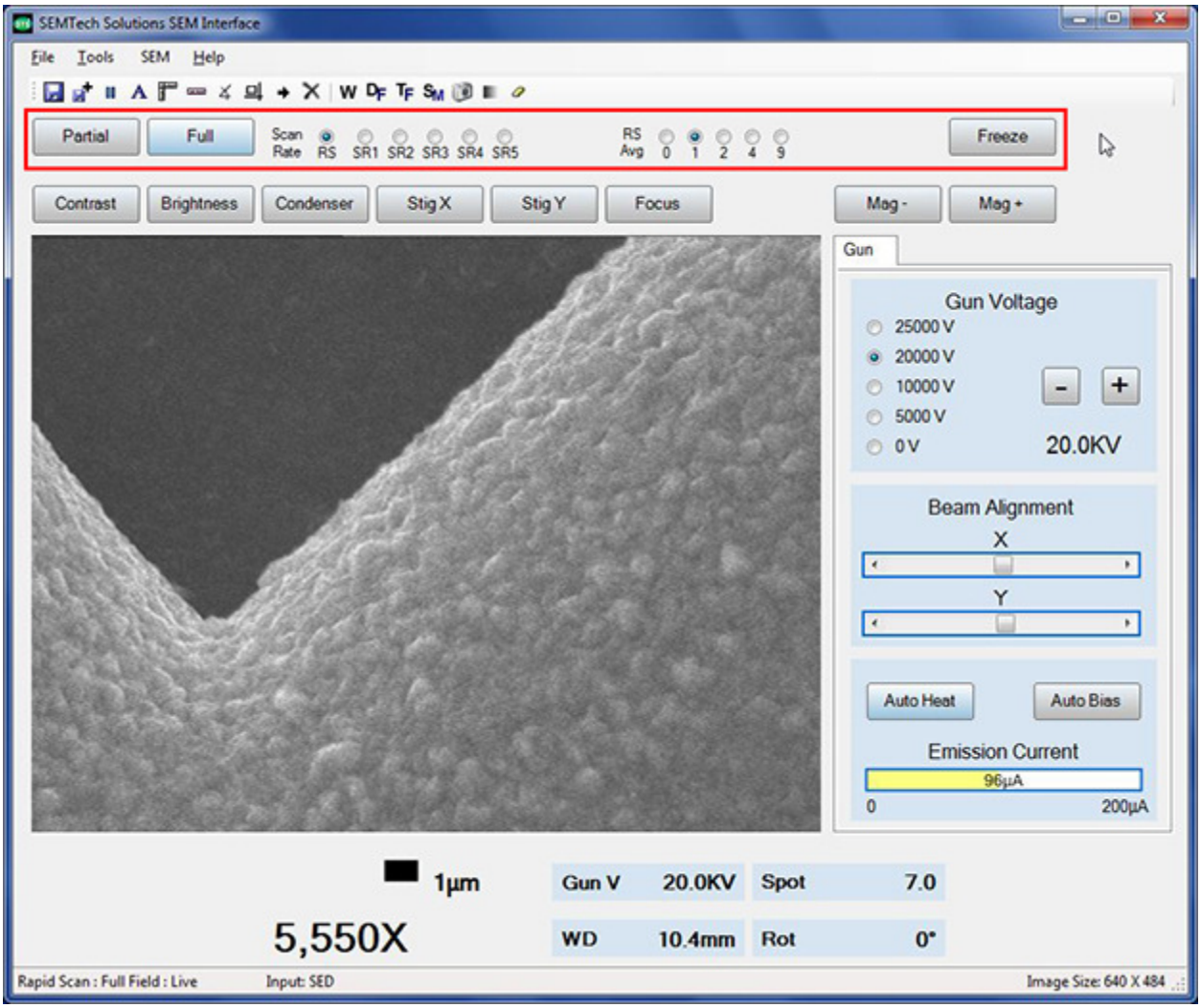


1.3 Scan Functions

The next set of buttons outlined in red below pertain to the scan functions.

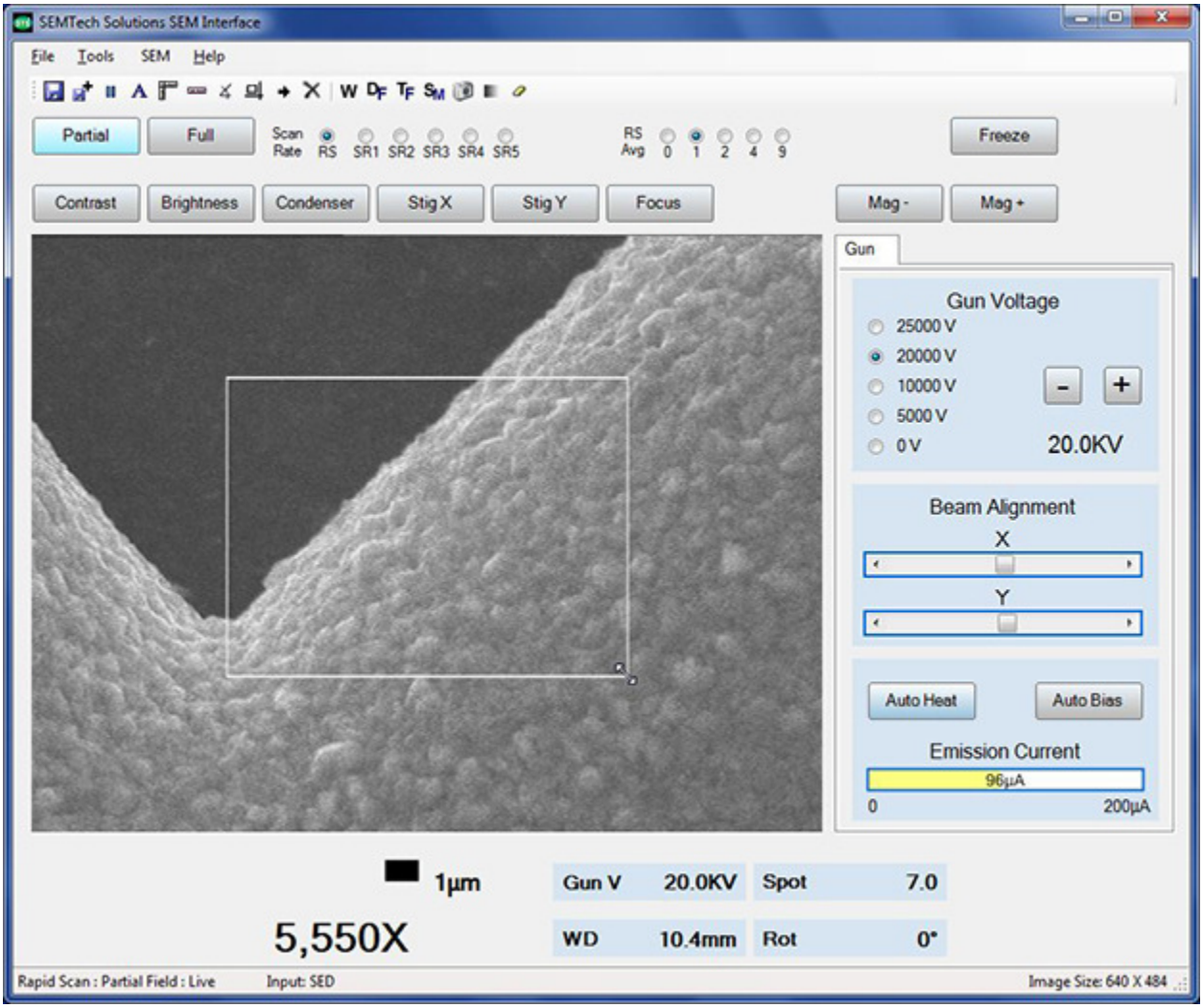
By examining the scan functions section we can determine the current scanning mode. The Full button tinted blue indicates that we are in full field mode. The Scan Rate is rapid scan since the RS radio button is selected. A rapid scan frame average (RS Avg) of 1 is being applied to the displayed image.

In full field mode the entire area displayed is scanned and the scan rate can be rapid scan or any of the slow scan modes. The rapid scan average (RS Avg) is only applied when rapid scan is selected.

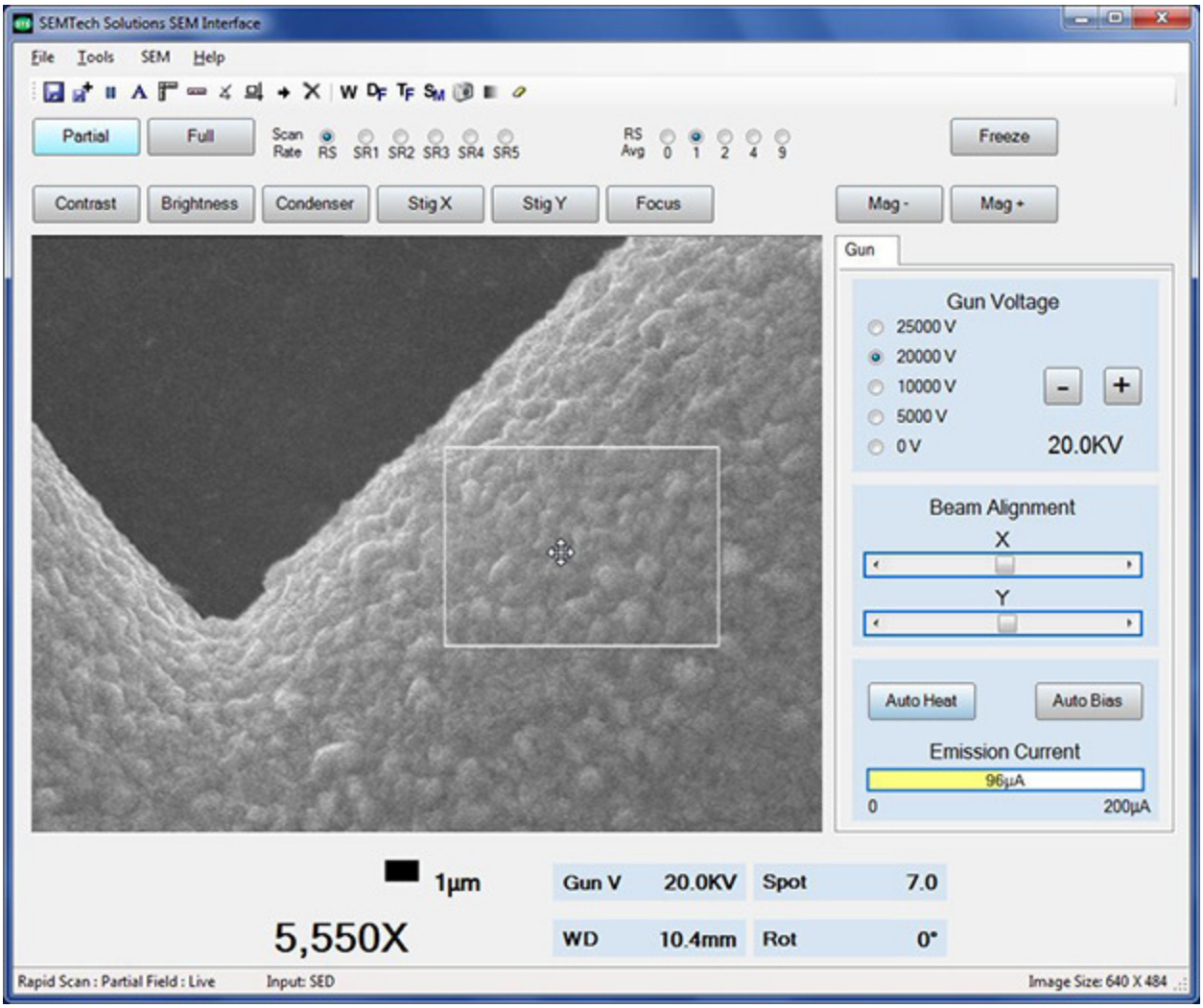


Left click on the Partial button to activate partial field mode. A reduced area inside the white rectangle is being scanned and everything outside of it is frozen. This mode can only be used in rapid scan.

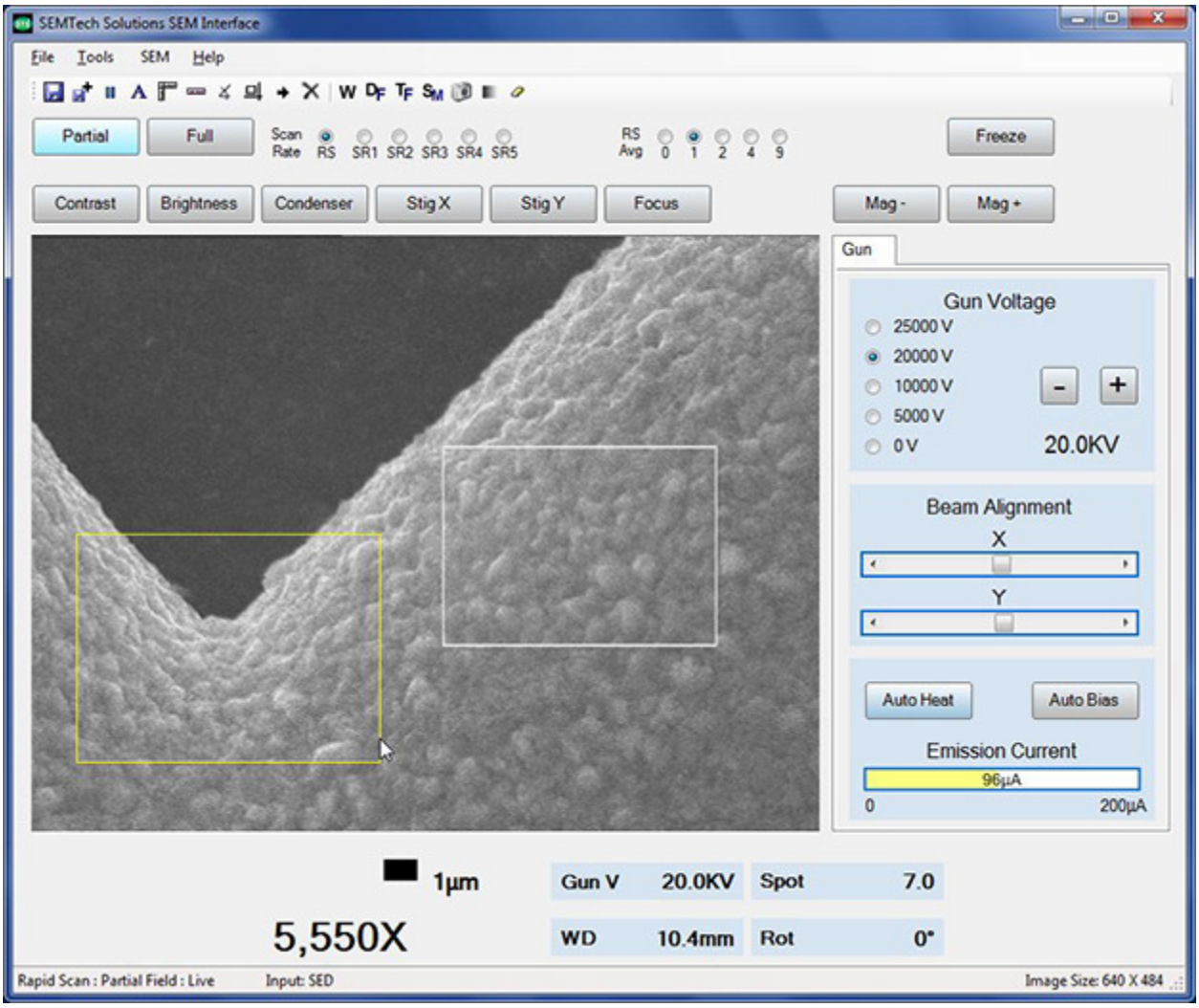
The Partial Field rectangle can be resized by hovering over the lower right corner of it with the mouse. When the diagonal arrow appears left click and drag the corner to resize the scan area to either a smaller or larger size. When the mouse button is released the new scan area will become active.



The partial field area can be moved by placing the mouse inside the rectangle. When the 4 headed arrow cursor appears left click and drag the rectangle to a new location. This mode is helpful for X-Ray analysis.



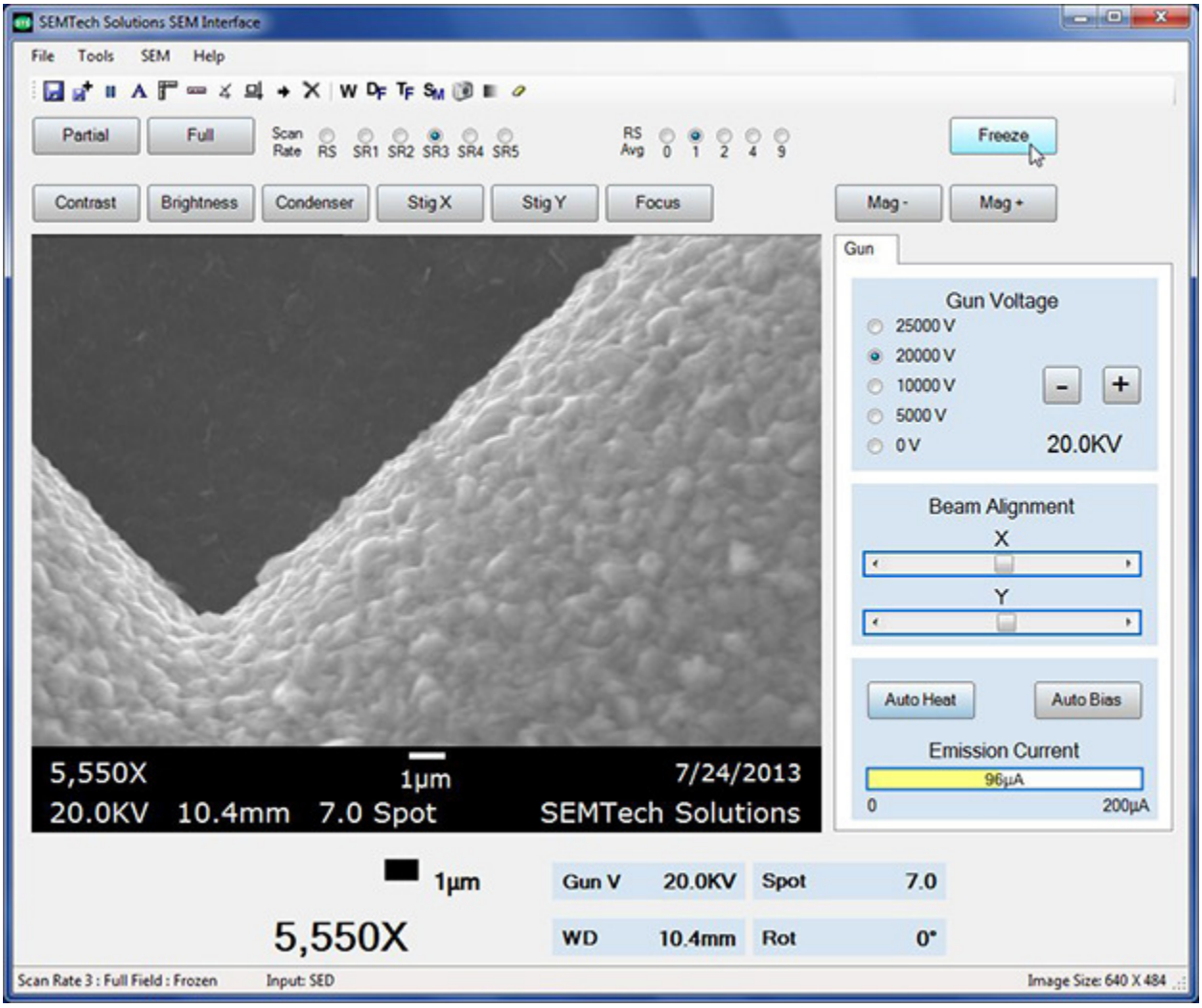
A new scan area can also be created by left clicking anywhere outside the current partial field rectangle and dragging the mouse to create a new rectangle. When the mouse button is released the new scan area will become active.



The Freeze button is used to capture the current image so it can be saved. The image below was acquired in full field by left clicking the scan rate 3 radio button (SR3) and then left clicking on the Freeze button. The image will scan from top to bottom in 32 seconds and freeze at the end of the scan. When the Freeze button is pressed the alphanumeric field will appear at the bottom of the image. This allows the acquire parameters to be saved along with the image. The alphanumeric can be configured to never show up, always on or only on during a freeze.

To save the acquired image select File>Save As. A standard Windows® Save File dialog will open. Select the directory where the image will be saved, enter a file name and chose a file format. The supported file formats are *.jpg, *.bmp, *.gif, *.tiff, or *.png.

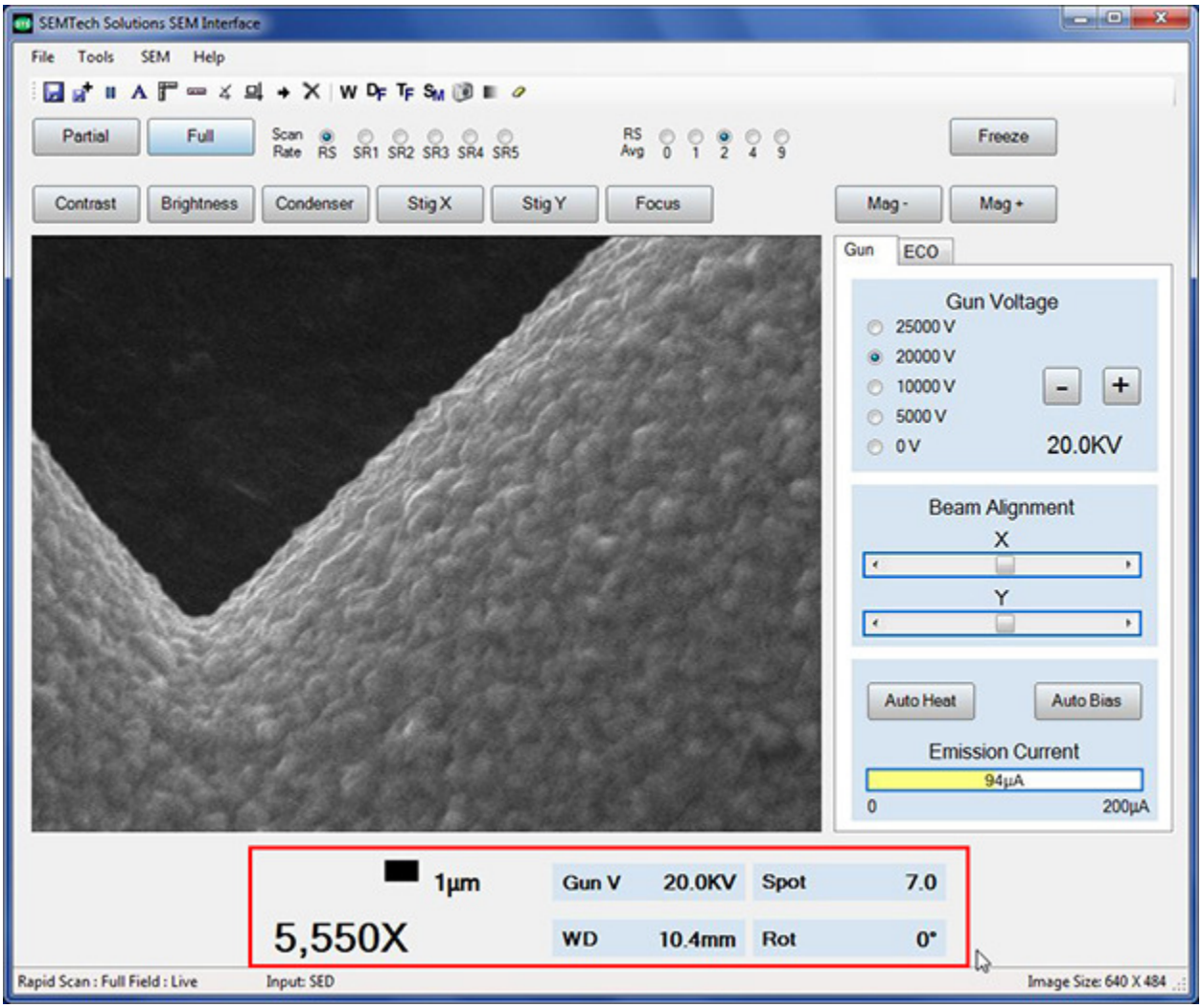
To unfreeze the image left click on either the Full or Partial button or on any of the Scan Rate radio buttons.

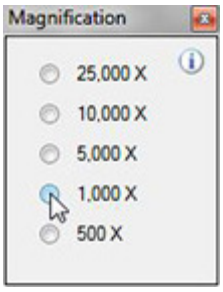


1.4 Quick Settings

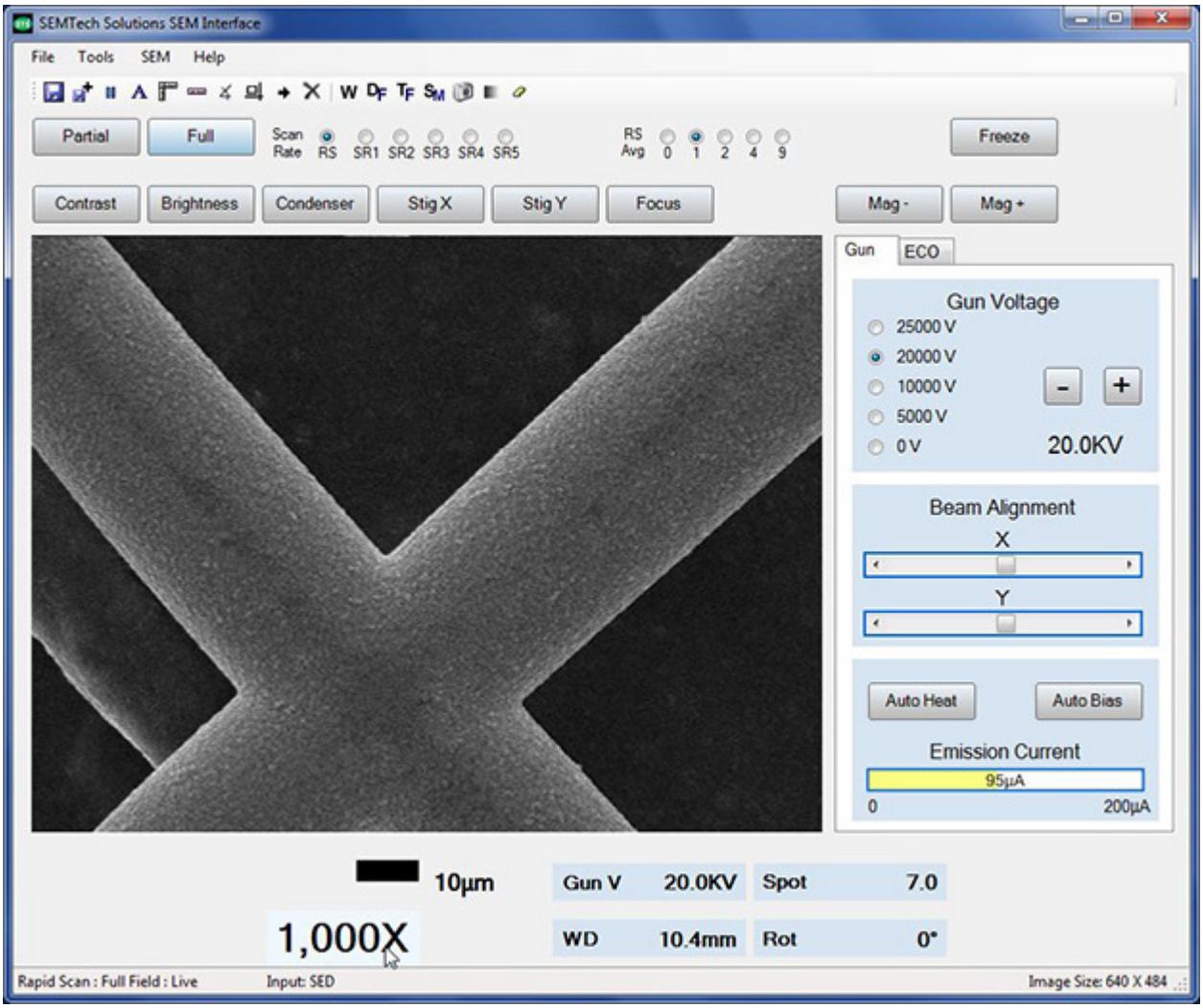
The label controls outlined in red are multifunction controls that allow quick access to common tasks. They allow the SEM parameters to be displayed and quickly changed to a new value. They are user configurable so that settings specific to a user's application can be set quickly.

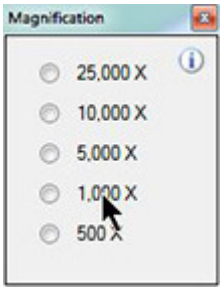
The Magnification label, "Gun V" label (gun voltage), "Spot" label (condenser lens setting), "WD" label (working distance) and "Rot" label (scan rotation) all work in a similar manner. They can be left clicked to bring up a quick setting dialog or right clicked for a specific setting dialog.





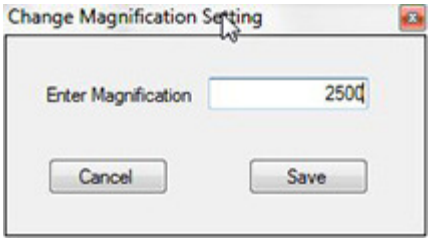
Left click on the Magnification label (5,550X). A dialog will open with five choices of magnification to choose from. Left click on the desired magnification radio button. The dialog will close and the magnification will be set to the selected setting.

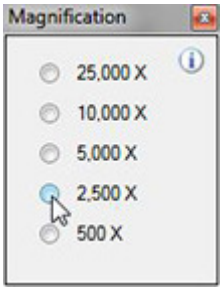




Left click on the Magnification label to open the quick Magnification dialog. Then right click on one of the magnification setting labels.

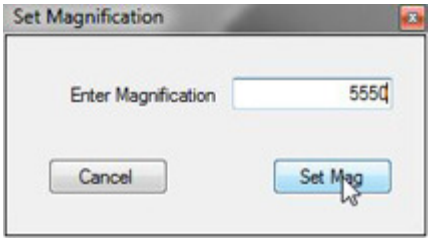
A dialog will open similar to the one on the right that enables the setting to be changed. Enter the new setting and left click the Save button. The new setting will be saved and the dialog will close.



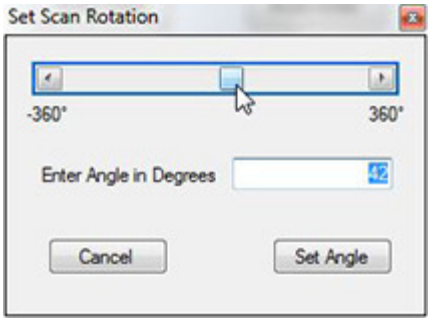


The setting entered will become the default value. All of the settings can be changed if desired.

Right click on the Magnification label. A dialog will open that allows a value to be typed into the Enter Magnification text box. When the Set Mag button is clicked the dialog will close and the magnification will be set to the value entered.



Right click on the Rot (scan rotation) label. A window will open that can be used to change the scan rotation. It has a horizontal scroll bar that allows for easy adjustment of scan rotation when aligning an image. Left click on the scroll box in the center of the control and drag it left or right to make adjustments. Or enter a value in the Enter Angle in Degrees text box and click the Set Angle button.



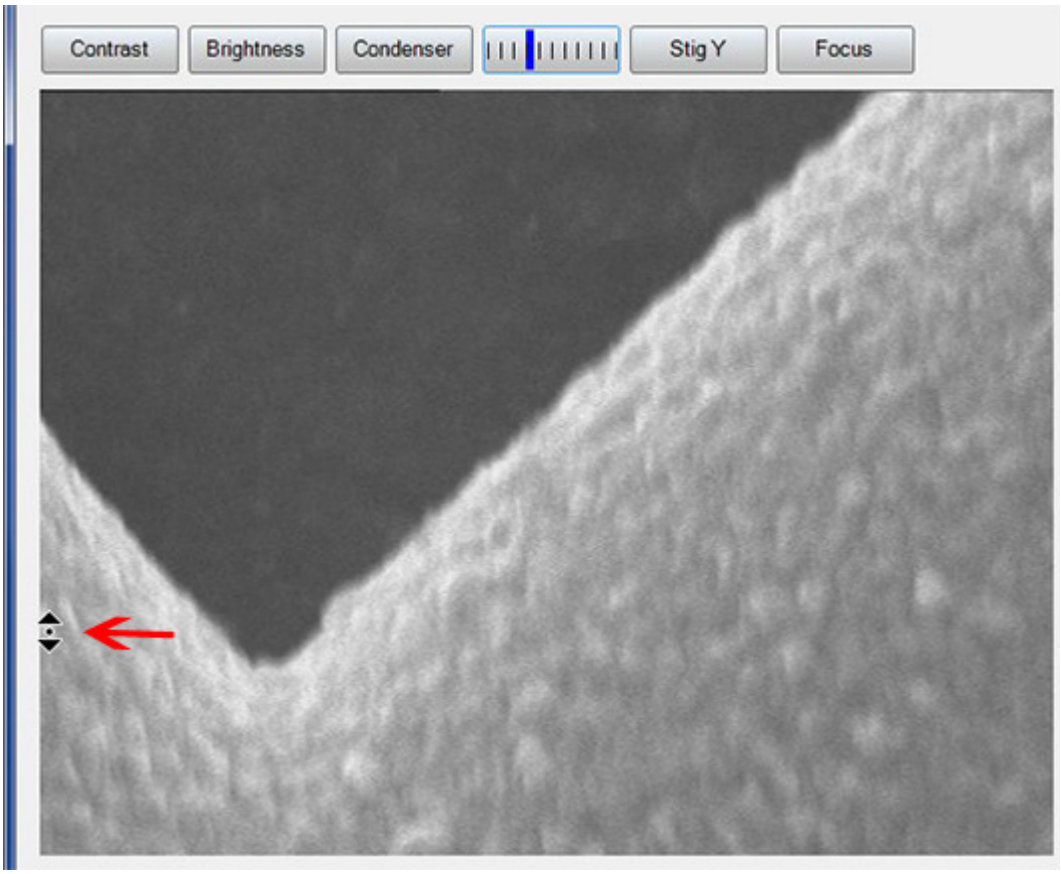
Chapter 2. Control Details

2.1 Image Adjust Buttons

The Image Adjust buttons are used to adjust the Contrast, Brightness, Condenser lens, Stigmator X and Y and to Focus the image. They all use the same click and drag function to adjust the image. The left mouse button is used for fine adjustment, the right mouse button applies a coarse adjustment and the middle mouse button is an extra coarse adjustment.

When one of the Image Adjust buttons is clicked the button face changes to an indicator gage and the cursor changes to a double headed arrow located on the left side of the image. The blue line in the indicator gage shows how much adjustment has been applied. When the blue line is in the center of the gage the amount of adjustment applied is in the center of its range. Move the mouse cursor up and down along the left side of the image to make an adjustment.

At lower magnifications use the right mouse button to make coarse adjustments. As the magnification increases use the left mouse button to focus and stigmate the image.



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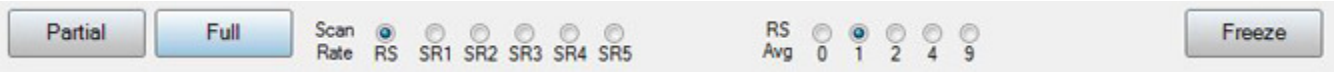
2.2 Magnification Buttons

The Mag - and Mag + buttons are used to adjust the magnification. The left mouse button is a slow zoom, the right mouse button is a fast zoom and the middle button zooms by a factor of 10. The mouse buttons may be clicked and released to apply a small change or they can be clicked and held to apply a continuous zoom. The Mag + button increases the magnification and the Mag - button decreases the magnification.

2.3 Scan Mode Buttons



2.3.1 Full Field Button

In full field mode the entire area displayed is scanned and the scan rate can be rapid scan or any of the slow scan modes. The Full button will be tinted blue when in full field mode. Use the Scan Rate radio buttons to select the scan rate when in full field mode as described below:

RS — Rapid Scan: The sample is scanned at 5 frames per second.
SR1 — Scan Rate 1: One frame is acquired in 8 seconds.
SR2 — Scan Rate 2: One frame is acquired in 16 seconds.
SR3 — Scan Rate 3: One frame is acquired in 32 seconds.
SR4 — Scan Rate 4: One frame is acquired in 64 seconds.
SR5 — Scan Rate 5: One frame is acquired in 128 seconds.

When rapid scan is selected frame averaging can be applied to the displayed image. Use the rapid scan average control (RS Avg) radio buttons to select the frame averaging applied to the displayed image as described in the table below:

RS Avg 0 — No averaging, each frame is displayed as it is acquired without averaging
RS Avg 1 — 2 frames are averaged together then displayed
RS Avg 2 — 4 frames are averaged together then displayed
RS Avg 4 — 16 frames are averaged together then displayed
RS Avg 9 — Kalman Filter, frames are averaged continuously until the Freeze button is pressed

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2.3.2 Partial Field Button

When the Partial button is clicked a white rectangle appears over the displayed image. The area inside the rectangle is being scanned and everything outside of it is frozen. This mode can only be used in rapid scan.

The rectangle can be moved to a different location. When the mouse cursor is moved inside the rectangle the cursor will change to a 4 headed arrow. When this occurs click the left mouse button and drag the rectangle to a new location.

The rectangle can be resized. Hover the mouse cursor over the lower right corner of the partial field rectangle. The mouse cursor will change to a 2 headed arrow. When this occurs click the left mouse button and drag the corner of the rectangle to resize it.

A new rectangle can be drawn at a different location on the displayed image. Left click anywhere outside the current partial field rectangle and drag the mouse to create a new rectangle. When the mouse button is released the new scan area will become active.

2.3.3 Freeze Button

The Freeze button is used to capture the current image so it can be saved. Pressing the Freeze button in rapid scan immediately freezes the image. Pressing the Freeze button when in slow scan will put the SEM in freezing mode. In freezing mode the button will blink while the slow scan frame is being acquired. When the slow scan frame reaches the bottom of the frame the image will be frozen and the button will stop blinking and be tinted blue.

When the image is frozen or freezing clicking the Freeze button will set the SEM state to full field live mode. The scan rate will be set to the rate that is currently selected by the Scan Rate radio buttons and the averaging will be the average currently selected by the RS Avg radio buttons.

The image can also be unfrozen by clicking on the Full button or any of the Scan Rate radio buttons.

Once frozen the image may be saved (See section 3.1) or measurements and text can be added to the image (See section 2.6) before it is saved.

An alphanumeric is added to the bottom of the frame by default. This can be turned off and is user configurable (see section 3.2).

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2.4 Scan Shift

Scan shift is performed by left clicking on the displayed image and dragging the area of interest to a new location. The scan mode must be full field and the magnification must be above 5000X. The magnification above which scan shift becomes active is user configurable (see section 3.2), but defaults to 5000X when the software is installed.

Note: Scan shift is also referred to as image shift.

Note: Scan shift is not active when the any of the following tool bar buttons are active "Insert Text or Symbols", "Measure Orthogonal", "Measure Any Direction", "Insert Shape" or "Insert Arrow".

Note: Scan shift will only be present when the wiring modifications have be performed after a software license has been purchased.

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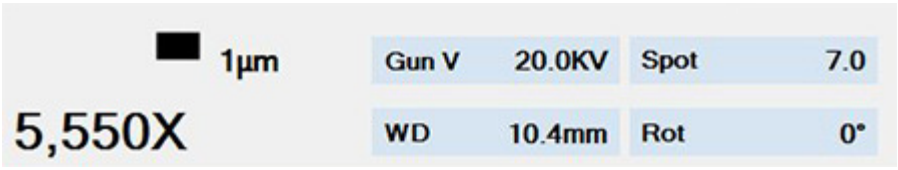
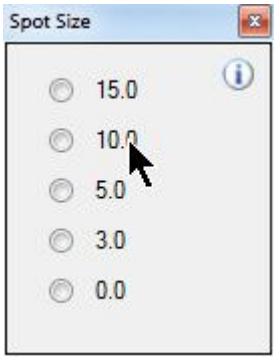
2.5 Label Controls



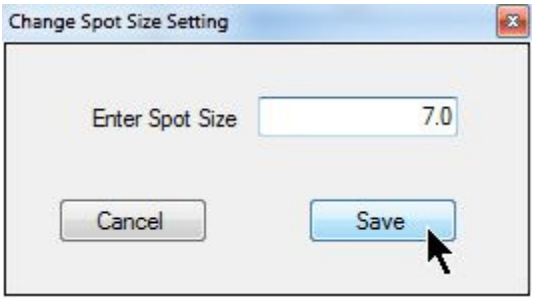
The label controls located at the bottom of the window are multifunction controls that allow quick access to common tasks. They allow the SEM parameters to be displayed and quickly changed to a new value. They are user configurable so that settings specific to a user's application can be set quickly.

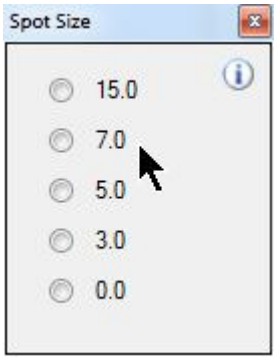
The Magnification label, "Gun V" label (gun voltage), "Spot" label (condenser lens setting), "WD" label (working distance) and "Rot" label (scan rotation) all work in a similar manner. They can be left clicked to bring up a quick setting dialog or right clicked for a specific setting dialog.



Left clicking on one of the label controls brings up a quick setting dialog similar to the one on the left. Left clicking on one of the radio buttons sets the SEM parameter to the setting selected and closes the quick setting dialog. Clicking on the information symbol in the upper right brings up a hint explaining how to change the value of a quick setting.

Right clicking on one of the labels on the quick setting dialog allows the value of the setting to be changed. A dialog similar to one on the right will open that enables the value to be changed. Clicking the Save button closes the dialog and the new setting will be available on the quick setting dialog as shown below.





The dialog on the left shows that the value that was 10.0 has been changed to 7.0 by right clicking on the 10.0 label. Then entering a new value for it in the Change Spot Size Setting dialog.

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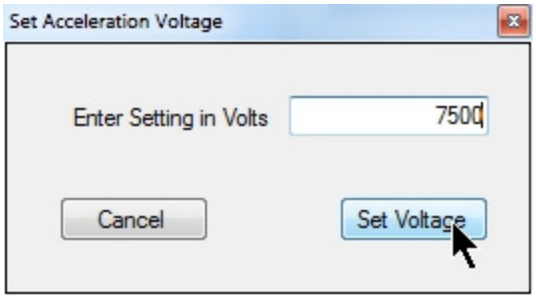
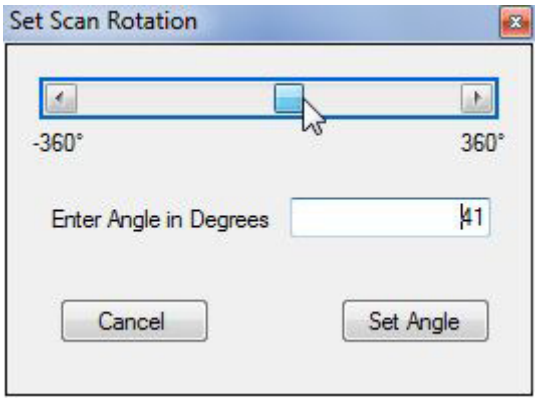
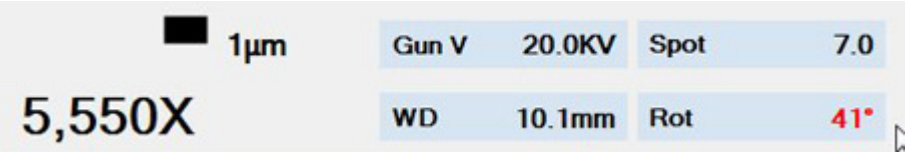
When one of the label controls is right clicked a dialog similar to the one on the right is opened. Enter the new setting in the text box and left click the Set button. The new setting will be applied and the dialog will close.





Right clicking on the scan rotation label control opens a dialog like the one on the left. It has an additional horizontal scroll bar that allows for easier adjustment of scan rotation when aligning an image. Left click on the scroll box in the center of the control and drag it left or right to make coarse adjustments. Click between the scroll box and the arrows on the ends of the control for a increase (or decrease) of 10 degrees. Click on one of the arrows on the ends of the scroll bar for and increase (or decrease) of 1 degree. The amount of scan rotation in degrees that is currently applied is updated in the text box as the value is changed with the scroll bar.

When the value of scan rotation is anything but zero degrees the setting will be displayed in red as shown below. This is a reminder that critical measurements should not be made on an image when scan rotation has been applied. Scan rotation may introduce distortion in the image.



2.6 Toolbar Buttons

Note: The toolbar buttons shown below may or may not be present depending on the system configuration.

Save as – Used to save the current image if it is frozen. Opens a Windows® save file dialog where a directory can be selected or created. Next select the file type (*.jpg, *.bmp, *.gif, *.tiff, or *.png) and enter a file name then click the Save button.

Save Incremental – Used to save the current image if it is frozen. Will append a numerical suffix to the end of the last saved file name and save the file to the same location where the last saved file was located using the same file type. If a numerical suffix was present on the last saved file then it is incremented and the file is saved to the same location where the last saved file was located using the same file type.

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Pause User Graphics and Text. This will temporarily erase all graphics on the screen. Clicking the button again will make them reappear. This button will be tinted blue when it is activated.

Insert Text or Symbols – Using the mouse, click on the image where you want the text to appear. Type the desired text and press the Enter key. Once the text is entered it can be moved to a new location by left-clicking on the text and dragging it to a new location. Clicking in another location allows you to type another line of text at the new location. To type a symbol follow the keystrokes outlined in the Help>Symbol Table menu item (see section 3.4). To edit text after the Enter key has been pressed double-click on the text. A dialog will open that will enable the text to be edited. Left clicking on the text and dragging it off the image erases it. This button will be tinted blue when it is activated, click again to deactivate it.

Measure Orthogonal – Click and drag the mouse down and to the right to create a box around the object to be measured. It will read out the horizontal (X), Vertical (Y) and diagonal (D) values. A measurement in only the X direction can be made by clicking a location and dragging the mouse up and to the right and a Y measurement can be made by clicking a location and dragging the mouse down and to the left. The measurement can be re-sized by clicking on a side, corner or endpoint of the graphic and dragging the mouse to resize it. The measurement can be re-positioned by clicking inside (or on) the graphic and dragging it to a new location. The measurement text can be moved by clicking on the text and dragging it to a new location. The measurement can be erased by dragging it off the image. This button will be tinted blue when it is activated, click again to deactivate it.

Measure Any Direction – Can be used to draw measurement lines in any direction. Click on a location and drag the mouse in any direction to create a measurement line. The measurement can be re-sized by clicking on an endpoint of the graphic and dragging the mouse to resize it. The measurement can be re-positioned by clicking on the graphic and dragging it to a new location. The measurement text can be moved by clicking on the text and dragging it to a new location. The measurement can be erased by dragging it off the image. This button will be tinted blue when it is activated, click again to deactivate it.

Measure Angle – Allows for angular measurements to be made on the image. Click on a location and drag the mouse in any direction to create an angular measurement. The angle can be changed by clicking on an endpoint or the vertex and dragging it to a new location. The measurement can be re-positioned by clicking on the graphic and dragging it to a new location. The measurement text can be moved by clicking on the text and dragging it to a new location. The measurement can be erased by dragging it off the image. This button will be tinted blue when it is activated, click again to deactivate it.

Insert Shape – Allows you to draw boxes or lines on the image. This works the same as Measure Orthogonal but no measurement text is shown. The shape can be erased by dragging it off the image. This button will be tinted blue when it is activated, click again to deactivate it.

Insert Arrow – Arrows can be drawn pointing to areas of interest. Click on a location and drag the mouse in any direction to create an arrow. The arrow can be re-sized by clicking on an endpoint of the graphic and dragging the mouse to resize it. The arrow can be re-positioned by clicking on the graphic and dragging it to a new location. The arrow can be erased by dragging it off the image. This button will be tinted blue when it is activated, click again to deactivate it.

Delete User Graphics and Text – Deletes all user graphics on the image.

Wobble Final Lens – Wobbles the final lens current to aide in aligning the final lens aperture. This button will be tinted blue when it is activated, click again to deactivate it.

Degauss Final Lens – Is used to degauss the lens for more accurate magnification readings. This should be done each time the gun voltage is changed manually using the + and – buttons. The lens is degaussed automatically when a radio button is used to change the gun voltage. To set a specific working distance degauss the final lens and set the working distance with either the focus control or by left (or right) clicking on the working distance label control and setting the desired working distance. Then use the Z motion on the stage to focus the image.

Tilt Focus – Is used to keep the image in focus from top to bottom when the stage is at a high tilt setting. Left clicking the toolbar button turns tilt focus on/off. Right-clicking on the button opens a dialog that allows the amount of focus compensation to be adjusted. Once the amount of compensation is set the dialog can be closed and the setting will be used each time tilt focus is activated by left clicking the button. This button will be tinted blue when it is activated, click again to deactivate it.

Toggle Chamber View – When clicked the SEM image will be replaced with the image from the chamber view. If no image appears make sure the chamber view power is turned on. Clicking the button again switches the image back to the SEM image. This button will be tinted blue when the chamber view video is selected, click again to switch back to SEM video.

Auto Contrast and Brightness – Clicking this button activates auto contrast and brightness. The SEM will analyze the image and automatically adjust the contrast and brightness. In this mode the Contrast and Brightness adjustment controls act as taste parameters allowing the user to adjust the automatic contrast and brightness set point. This button will be tinted blue when it is activated, click again to deactivate it.

Erase SEM Annotation – At times the SEM annotation or graphics may appear on the displayed image. This can occur if the SEM electronics console is turned off and then back on or during SEM calibration. Clicking the Erase SEM Annotation button will send a command to the SEM to erase all annotation and graphics.

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Invert Video – The video signal is displayed inverted when clicked. This button will be tinted blue when inverted video is active, click again to revert to normal video.

Open/Close V1 – When equipped with a pneumatic or motorized V1 valve the valve can be opened or closed by clicking this button. Each click will toggle the valve to the opposite state. This button will be tinted blue when the V1 valve is open.

TV Rate - On systems that have integrated TV rate clicking this button will turn on TV rate. In TV rate the sample is scanned at 30 frames per second. This may be useful on samples that are non conductive to reduce sample charging. This button will be tinted blue when TV rate is on and the Line Scan, Spot Mode, Dual Magnification and Split Screen buttons will be disabled.

Line Scan - Activating line scan freezes the image then scans the sample along a single line. A reference line is drawn on the displayed image where the beam is scanning the sample. The signal from the active detector is displayed as a line across the image which is modulated by the variations in the signal level.

The reference line can be moved by hovering the cursor over the line until the cursor changes to a four headed arrow. Then left click and drag the line to a new area. When the mouse button is released the reference line will move to the new area.

The line can be scanned at slow scan rates 1 through 5 in line scan mode. Freeze the image to make measurements or to add text or symbols to the acquired image. This button will be tinted blue when line scan is on an the TV Rate, Spot Mode, Dual Magnification and Split Screen buttons will be disabled.

Dual Magnification - Clicking the Dual Magnification tool bar button displays two side by side images. The image on the left is at a lower magnification and has a rectangle drawn on it. The area inside this rectangle is displayed on the right side at a higher magnification.

The rectangle on the left can be moved by hovering the mouse over the rectangle until the cursor changes to a four headed arrow, then left click and drag the rectangle to a new area. The new area will be scanned once the mouse button is released.

The rectangle on the left can be re-sized by hovering over the lower right corner of the rectangle until the cursor changes to a north-west / south-east arrow, then left click and drag the rectangle to re-size it. When the mouse button is released the new area will be scanned. Re-sizing the rectangle changes the magnification of the image displayed on the right. The magnification for each side is displayed on the bottom left and bottom right side of the alphanumeric. See section 3.2 (Tools > Customize) for displaying the alphanumeric.

Dual magnification images can be acquired in rapid scan or slow scan. Freeze the image to make measurements or to add text or symbols to the acquired image. This button will be tinted blue when dual magnification is on and the TV Rate, Line Scan, Spot Mode and Split Screen buttons will be disabled.

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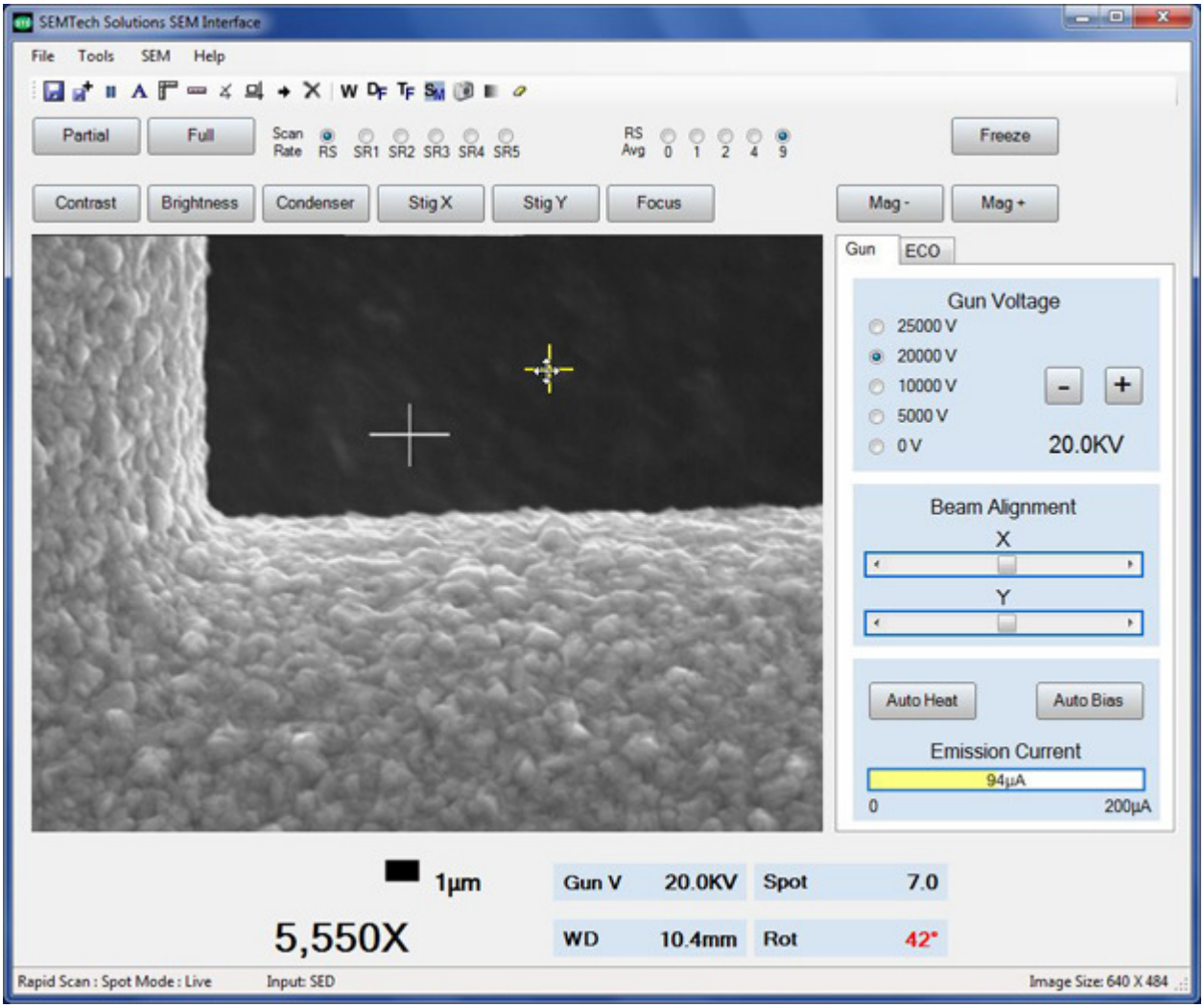
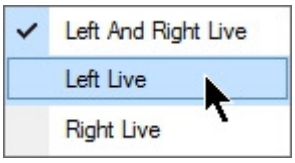
Spot Mode — When clicked the image is frozen and a cross hair is placed on the image. The electron beam strikes the sample without scanning at the point where the cross hair is located. The cross hair can be moved by hovering over the cross hair until the mouse cursor changes to a 4 headed arrow. When this occurs left click on the cross hair and drag it to a new location.



The beam will strike the sample at the new location when the mouse button is released. Spot mode is usually used in conjunction with X-Ray analysis. This button will be tinted blue when it is activated and the TV Rate, Line Scan, Split Screen and Dual Magnification buttons will be disabled.

Auxiliary Video - Activating this button will cause the signal connected to the auxiliary video channel to become the active video signal. This button will be tinted blue when it is activated, click again to deactivate it.

Split Screen - When clicked the center section of the current image is scanned twice during each scan line. This is displayed on the screen as two side by side images. This mode is usually used to display a side by side comparison of the secondary electron detector signal and an auxiliary video signal such as a backscatter detector.

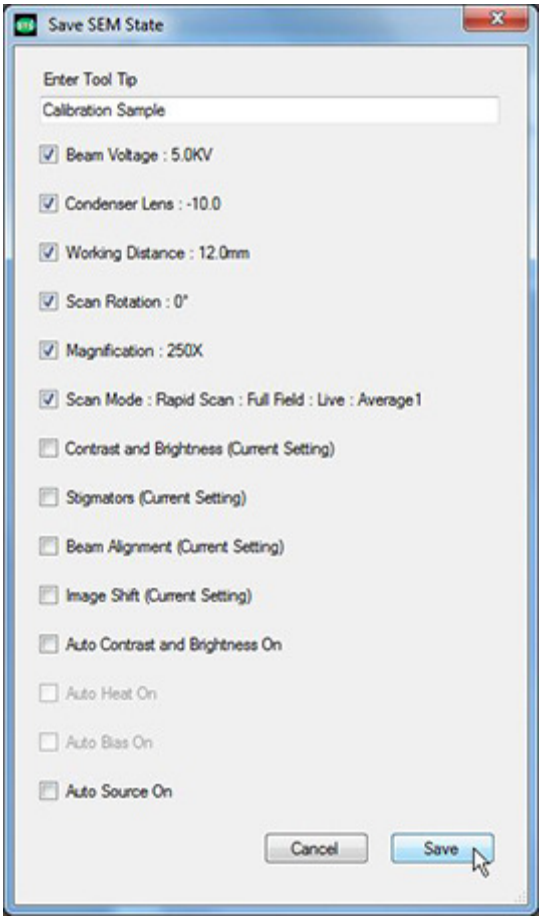


Left click the Split Screen tool bar button to toggle split screen mode on/off. When split screen is active right click on the Split Screen tool bar button to open a context menu that controls the live side of the image. The signal displayed on the live side of the image is selected using the Auxiliary Video tool bar button.

For example an image with the secondary electron detector signal on the left and a backscatter detector signal on the right can be obtained using the following method. With the secondary electron signal active turn on split screen mode. Right click the Split Screen tool bar button and select either Left And Right live or Left Live. Obtain the desired image for the left side and then right click the Split Screen tool bar button and select Right Live. Next activate the backscatter detector signal by clicking the Auxiliary Video tool bar button. Obtain the desired image on the right side and then click the freeze button.

Split screen images can be acquired in rapid scan or slow scan. The Split Screen button will be tinted blue when in split screen mode and the TV Rate, Line Scan, Spot Mode and Dual Magnification buttons will be disabled.

SEM State 0 thru SEM State 9 - These tool bar buttons appear when the user adds a SEM state by right clicking on an open area of the tool strip to the right of the tool bar buttons and selecting Add SEM State. A form opens that shows the present conditions of the SEM. This feature is useful for saving the SEM conditions used to view a specific sample or setting a start up condition.



Start by obtaining an image of a sample with the desired SEM operating conditions. Then right click on an open area of the tool strip and select Add SEM State. When the Save SEM State form opens enter a tool tip in the Enter Tool Tip text box. The text entered here will be displayed when the cursor is hovered over the tool bar button. Then check the boxes next to the SEM settings that are to be set when the newly created tool bar button is clicked. When the Save button is clicked a tool bar button will be added to the tool strip. It will have the next lowest available icon ranging from S0 thru S9. Only ten SEM state tool bar buttons are available. More SEM states can be saved using the File > Save SEM State menu item (See section 3.1).

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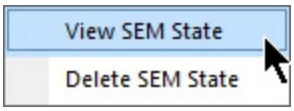
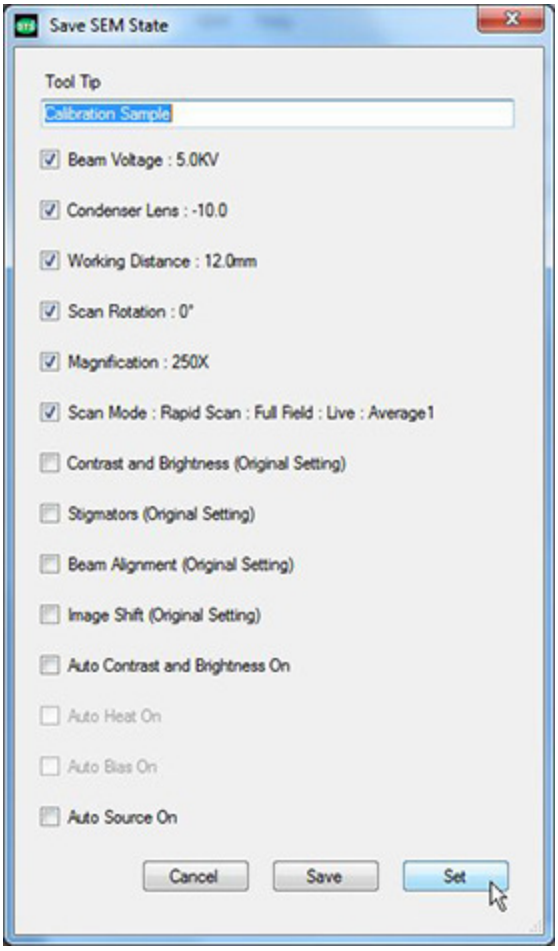
Right click on a SEM State tool bar button to open a context menu that allows the SEM state to be viewed or deleted. Clicking the Delete SEM State context menu item deletes the SEM state and removes its tool bar button. Selecting the View SEM State context menu item opens a form that that shows the settings for the selected SEM state.





The form opened is the same as the form used to create the SEM state except that it has an additional Set button. The settings shown are the original SEM conditions from when the SEM state was created (not the current SEM conditions). The tool tip can be changed or the check boxes can be checked or unchecked as desired. If the conditions are changed select the Save button to save the new conditions. Click the Set button to set the SEM to the SEM State conditions. Clicking the cancel button closes the form without setting or saving the SEM state conditions.

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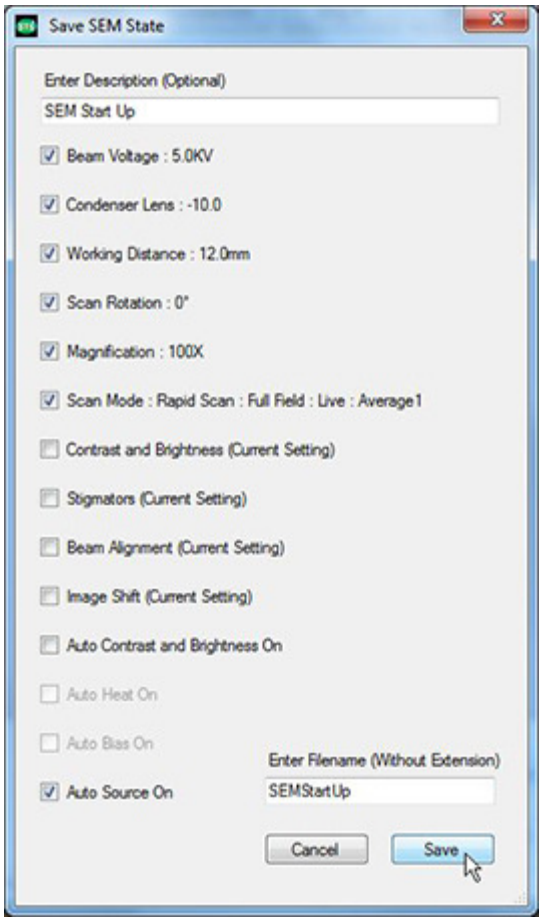
Chapter 3. Menu and Status Strip

3.1 File Menu

- Save SEM State - Opens the Save SEM state form that enables the current SEM conditions to be saved. Start by obtaining an image of a sample with the desired SEM operating conditions. Then select "File > Save SEM State" to open the Save SEM State form. Once opened enter an optional description in the Enter Description text box. Then check the check boxes next to the SEM conditions that are to be saved. Enter a file name in the Enter Filename text box and click the Save button to save the SEM state.



  - Load SEM State - Opens an Open File dialog that is used to navigate to and open a saved SEM state file. The file extension for a SEM state file is .sem. Click on the desired file and click the open button. A form will open that is similar to the Save SEM State form except that it will have additional Delete and Set buttons. The settings shown are the original SEM conditions from when the SEM state was created (not the current SEM conditions). The description can be changed or the check boxes can be checked or unchecked as desired. If the conditions are changed select the Save button to save the new conditions. Click the Set button to set the SEM to the SEM State conditions and close the form. Clicking the delete button will delete the SEM state and close the form. Clicking the cancel button closes the form without setting or saving the SEM state conditions.
  - Set SEM State - Opens an Open File dialog that is used to navigate to a saved SEM state file. Once the file is selected and the Open button is clicked the SEM is set to the conditions contained in the selected SEM state file and the Open File dialog is closed.
- Save – Used to save the current image if it is frozen. It will append a numerical suffix to the end of the last saved file name and save the file to the same location where the last saved file was located using the same file type. If a numerical suffix was present on the last saved file then it is incremented and the file is saved to the same location where the last saved file was located using the same file type.
- Save As – Used to save the current image if it is frozen. Opens a Windows® save file dialog where a directory can be selected or created. Next select the file type (*.jpg, *.bmp, *.gif, *.tiff, or *.png) and enter a file name then click the Save button.
- Exit – Closes the software.

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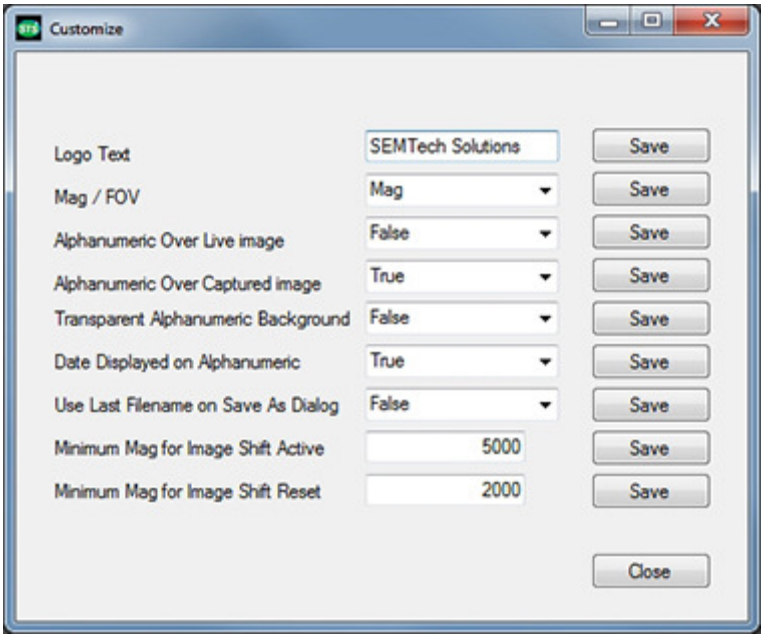
3.2 Tools Menu

- Customize – Opens a window that allows user configurable parameters to be changed. Once a setting has been changed click the Save button for the setting.



◊ Logo Text – Text entered in this field will be visible on the bottom right of the alphanumeric displayed across the bottom of the image when the alphanumeric is visible.

◊ Mag/FOV – Toggles between Magnification and Field of View. Since the magnification is based off a Polaroid® photo (5" X 4"), it is not correct for the read out displayed on the monitor or on the media that the image will be printed to. Field of View and the micron bar are always correct. Most users prefer some type of magnification reading instead of FOV.

◊ Alphanumeric Over Live Image – Set to True or False. The alphanumeric will be visible at the bottom of the image anytime the image is live (not frozen) when the value is set to True.

◊ Alphanumeric Over Captured Image – Set to True or False. The alphanumeric will be visible at the bottom of the image anytime the image is frozen when the value is set to True.

◊ Transparent Alphanumeric Background — Set to True of False. The alphanumeric will be displayed and saved without a background when the value is set to true. When false the alphanumeric will have a black background.

◊ Date Displayed on Alphanumeric – Set to True or False. The date will appear on the alphanumeric above the logo text when this value is set to True.

◊ Use last Filename on Save As Dialog - When set to true the last saved filename will appear as the default filename when the Save As… tool bar button or menu item is clicked. When set to false the default filename will be blank.

◊ Minimum Mag for Image Shift Active – Set this value to the preferred magnification above which image shift is available using the mouse. The value should be 5000x or greater.

◊ Minimum Mag for Image Shift Reset – Set this value to the preferred magnification below which the image shift will reset the digital shift values to zero. It should be set to 2000x or greater based on the Image Shift Active value, but always less than the Image Shift Active value.

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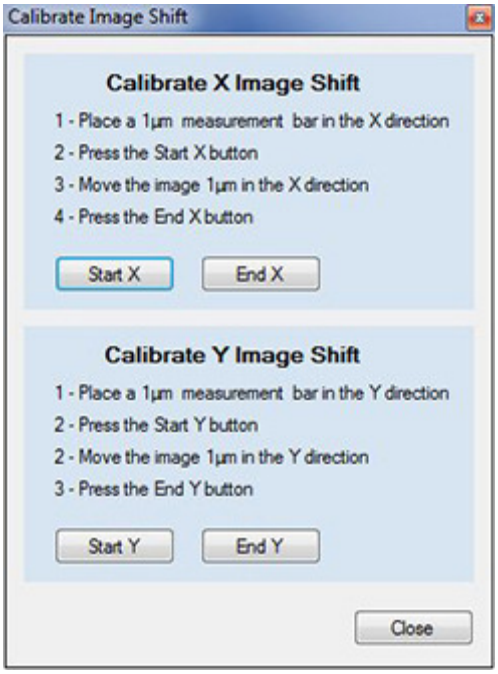
- Calibrate Image Shift – Opens a window that is used to calibrate the image shift so that when clicking and dragging the area of interest it will follow the mouse.


Calibrate Image Shift
Calibrate X Image Shift
1 - Place a 1µm measurement bar in the X direction
2 - Press the Start X button
3 - Move the image 1µm in the X direction
4 - Press the End X button
Start X
End X
Calibrate Y Image Shift
1 - Place a 1µm measurement bar in the Y direction
2 - Press the Start Y button
2 - Move the image 1µm in the Y direction
3 - Press the End Y button
Start Y
End Y
Close

Acquire an image and set the magnification so that a 1µm measurement bar will span a good distance in the displayed image, approximately 25000X to 30000X depending on the working distance.

Click on the Measure Orthogonal tool bar button and place a 1µm measurement bar in the X direction. Click the Measure Orthogonal tool bar button again to deactivate placing measurement bars and activate image shift. (Image shift is not active when the any of the following tool bar buttons are active "Insert Text or Symbols", "Measure Orthogonal", "Measure Any Direction", "Insert Shape" or "Insert Arrow").

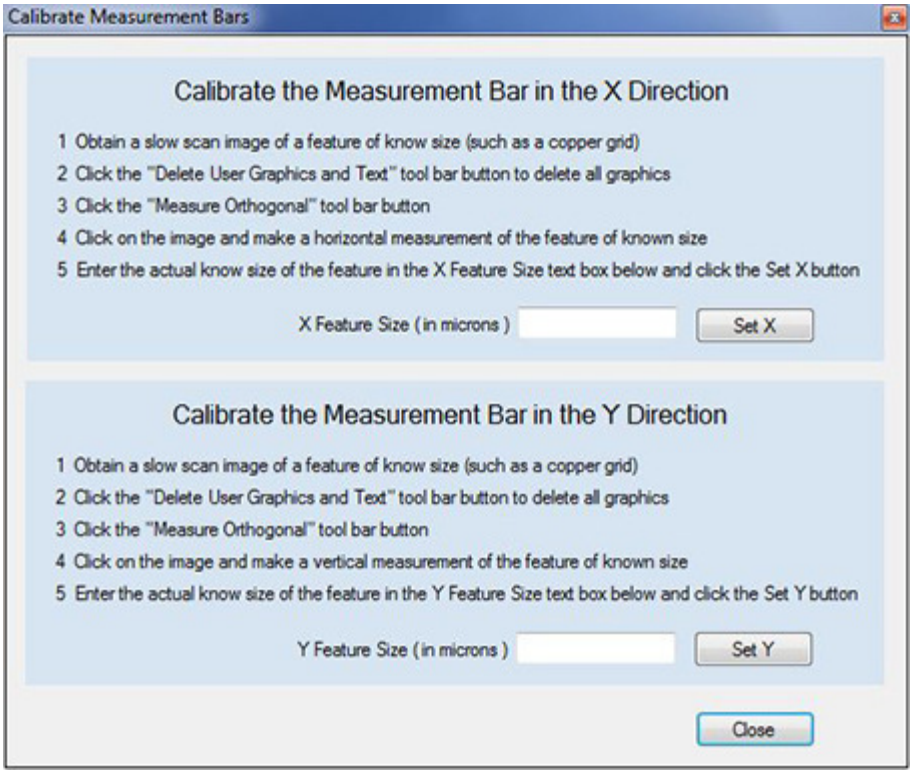
Press the Start X button.

Click on the image and drag a feature 1µm in the X direction.

Press the End X button.

Repeat this procedure for the Y direction except when drawing the measurement bar draw it in the Y direction and drag the image in the Y direction. Repeating this procedure may improve the image shift tracking if the initial calibration was far out of calibration.

- Calibrate Measurement Bar – When clicked the Calibrate Measurement Bar item opens a form that enables the measurement bars to be calibrated to a feature of known size. This allows a user to calibrate the measurement bars and magnification to a standard of their choosing. Follow the directions on the Calibrate Measurement Bar form to calibrate the X and Y field of view scale factors.


Calibrate Measurement Bars
Calibrate the Measurement Bar in the X Direction
1 Obtain a slow scan image of a feature of know size (such as a copper grid)
2 Click the "Delete User Graphics and Text" tool bar button to delete all graphics
3 Click the "Measure Orthogonal" tool bar button
4 Click on the image and make a horizontal measurement of the feature of known size
5 Enter the actual know size of the feature in the X Feature Size text box below and click the Set X button
X Feature Size (in microns)
Set X
Calibrate the Measurement Bar in the Y Direction
1 Obtain a slow scan image of a feature of know size (such as a copper grid)
2 Click the "Delete User Graphics and Text" tool bar button to delete all graphics
3 Click the "Measure Orthogonal" tool bar button
4 Click on the image and make a vertical measurement of the feature of known size
5 Enter the actual know size of the feature in the Y Feature Size text box below and click the Set Y button
Y Feature Size (in microns)
Set Y
Close

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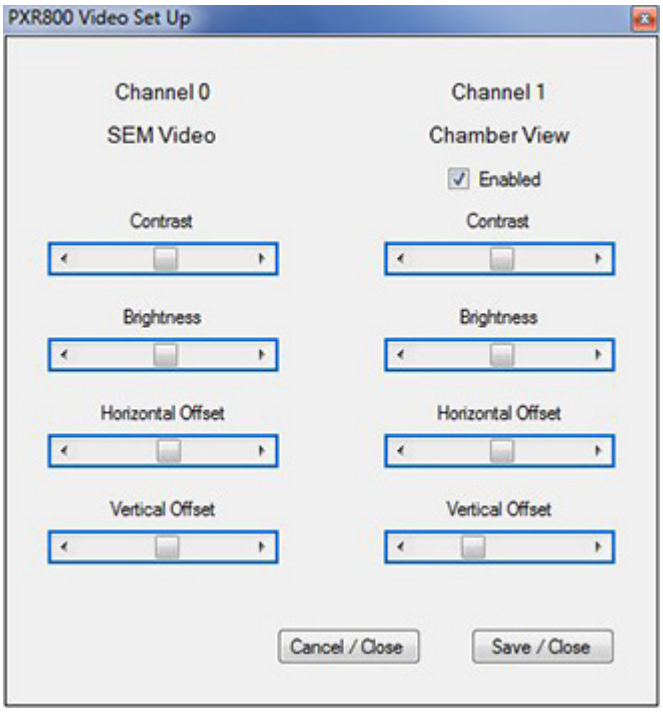
♦ Video Settings – Clicking on Video Settings menu item opens a form that is used to adjust the frame grabber video setting. Depending on the frame grabber installed in the PC the form opened when Video Settings is clicked will differ.

◊ PXR800 Frame Grabber

There are two columns on the PXR800 Video Set Up form. One for the SEM video and one for the Chamber View video. If a chamber view is not installed uncheck the Enabled check box under the Chamber View column.



- Contrast – Adjusts the contrast electronically using the PXR800 gain setting. For the SEM Video it is best to leave this setting in the middle of its range. For the Chamber View (if present) adjust this setting for the desired contrast level when the chamber view image is visible.
- Brightness – Adjusts the brightness electronically using the PXR800 offset setting. For the SEM Video it is best to leave this setting in the middle of its range. For the Chamber View (if present) adjust this setting for the desired brightness level when the chamber view image is visible.
- Horizontal Offset – If a black band is visible on the left or right side of the image adjust this setting to eliminate the band for both the SEM video and the Chamber View.
- Vertical Offset – If a black band is visible on the top or bottom of the image adjust this setting to eliminate the band for both the SEM video and the Chamber View. If the band cannot be eliminated on the SEM image adjust it so that the band is on the bottom of the image. The bands cannot be removed on the chamber view image. Adjust the setting so that the bands are even on the top and bottom of the image.
- Clicking the Save/Close button saves the setting and closes the form. Closing the form with the Cancel/Close button sets the setting back to the state they were in before the form was opened and then closes the form.

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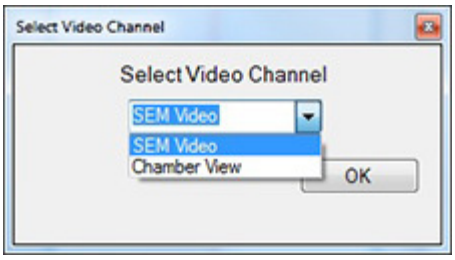
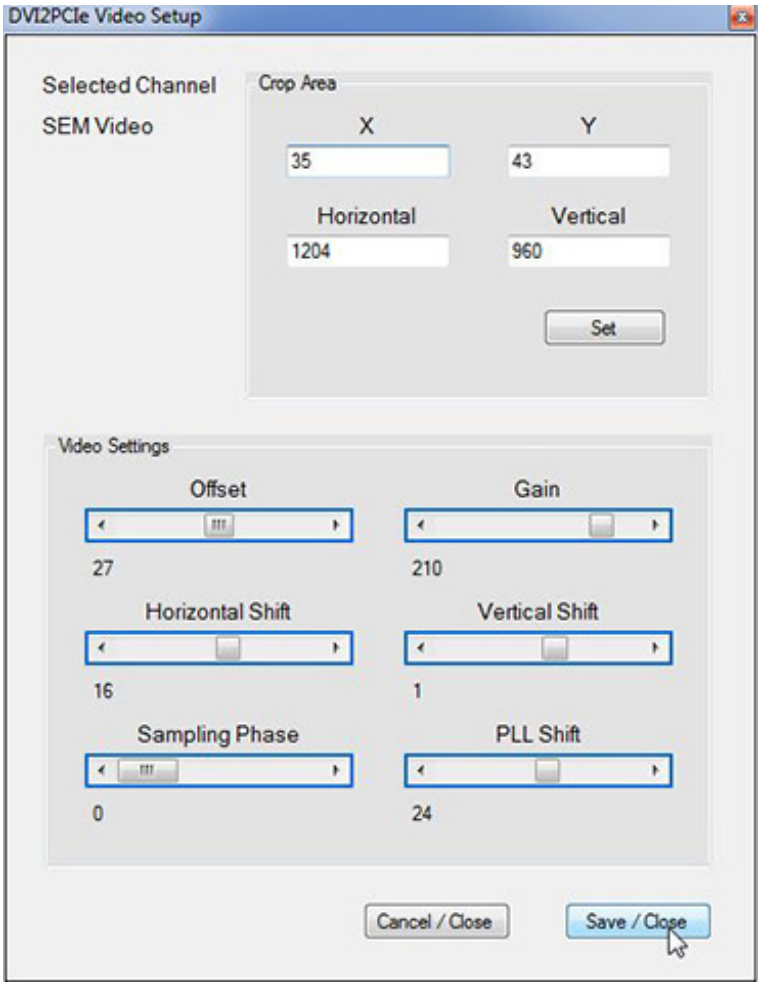
◊ DVI2PCIe Frame grabber



Clicking on the Video Settings menu item when the DVI2PCIe frame grabber is installed opens a dialog that enables the SEM video or the Chamber View video settings to be adjusted. Select the video channel to adjust in the Select Video Channel combo box and click the OK button. The dialog will close and the DVI2P-CIe Video Setup form will open for the selected video channel.



The DVI2PCIe frame grabber acquires a frame that is larger than the SEM image area. Use the Crop Area to eliminate unwanted areas of the acquired image and to obtain a displayed image of 1200 X 960. The displayed image size is shown on the right side of the status bar of the SEM Interface UI. It may be necessary to set the Horizontal value a few pixels larger than 1200 and then adjust the PLL Shift to obtain a displayed image size of 1200 X 960. The image on the left shows typical values for a 3xxx series SEM.

- X — The location of the left side of the crop area.
- Y — The location of the top of the crop area.
- Horizontal — The width of the crop area.
- Vertical — The height of the crop area.
- Offset — Adjusts the brightness electronically using the DVI2PCIe offset setting. For the SEM Video it is best to leave this setting in the middle of its range. For the Chamber View (if present) adjust this setting for the desired brightness level when the chamber view image is visible.
- Gain — Adjusts the contrast electronically using the DVI2PCIe gain setting. For the SEM Video it is best to leave this setting in the middle of its range. For the Chamber View (if present) adjust this setting for the desired contrast level when the chamber view image is visible.
- Horizontal Shift — It is usually not necessary to adjust this setting.
- Vertical Shift — It is usually not necessary to adjust this setting.

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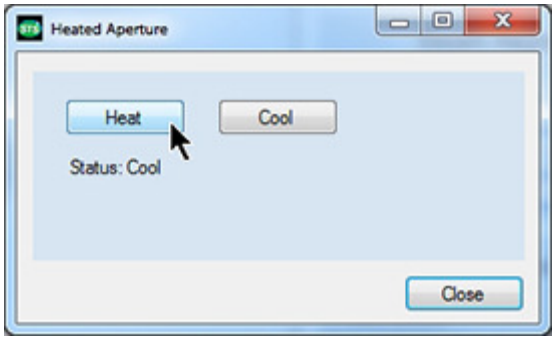
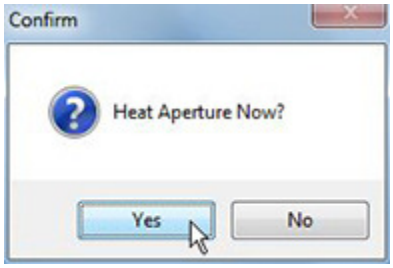
- Sampling Phase — It is usually not necessary to adjust this setting.
- PLL Shift — Use this setting in conjunction with the Crop Area Horizontal setting to obtain a displayed image size of 1200 X 960.

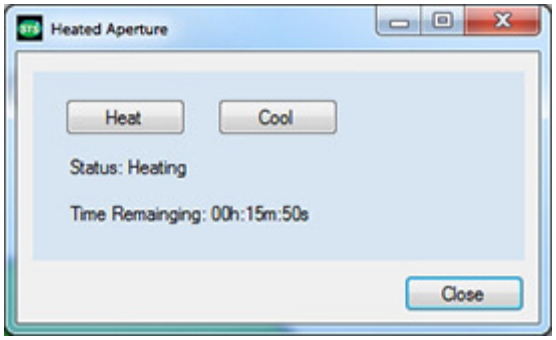
♦ Heated Aperture - Opens a form that is used to heat or cool the heated aperture (if present). The status of the heated aperture and the time remaining on a heating or cooling cycle is also displayed on the Heated Aperture form.



When the heated aperture is cool click the Heat button to begin the heating cycle.

A dialog will open asking for confirmation to heat the aperture. Click the Yes button to proceed. Since heating (and cooling) the aperture can take a considerable amount of time and the SEM cannot be used during this process choose wisely.

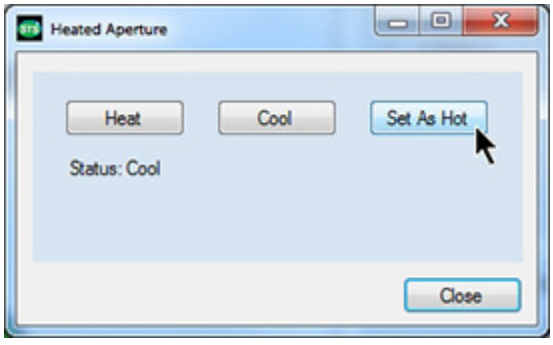




While the aperture is heating the status will display Heating and the time remaining will be displayed. When the heating cycle is complete the status will display Heated.

To cool a heated aperture click the Cool button and then the Yes button when the confirmation dialog opens. The status will display Cooling and the time remaining will be displayed. When the cooling cycle is complete the status will display Cool.

Some systems have a Set As hot button. This button overrides the standard heating process and sets the rod to the heated state without waiting for the heat cycle to complete. This button is used after the SEM vacuum electronics is reset while the aperture is hot. Consult your service engineer about when it is safe to click this button.



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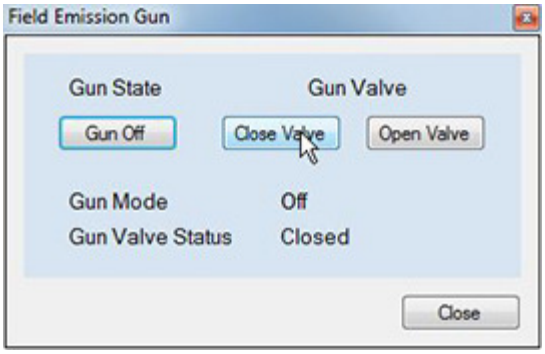
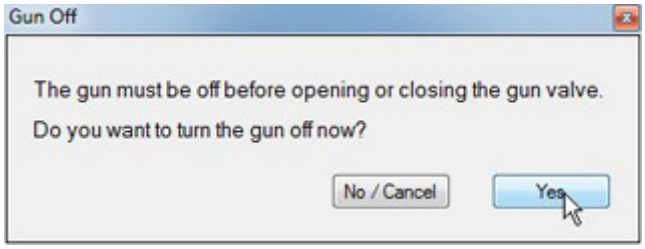
- FE Gun Valve — Opens a dialog that enables an pneumatic gun valve to be opened or closed. Before the gun valve can be opened or closed the Gun Mode must be Off. This menu item is only available if the system has a pneumatic gun valve.



If the Close Valve button or Open Valve button is clicked and the Gun Mode is not Off another dialog opens which prompts the user to turn off the gun.



- FE Gun Settings — Opens a password protected window that allows the gun parameters to be changed by SEMTech Solutions personnel. Only available if the system has a field emission gun.
- Configuration — Opens a password protected window that allows the system to be configured by SEMTech Solutions personnel.

3.3 SEM Menu

The following SEM Menu items may or may not be present depending on the system configuration.

- Source Image — Is used to turn source imaging on or off. This is used in conjunction with a LAB6 source to aide in properly saturating it.
- Column Valve — Is used to open or close a pneumatic (or motorized) column valve. The column valve is also referred to as the V1 valve.
- Wobble Final Lens — Is used to turn on or off wobbling of the final lens. Wobbling the final lens current aides in aligning the final lens aperture.

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- Degauss Final lens — Degausses the final lens when clicked. Degaussing the final lens is required for accurate magnification readings when the beam voltage is changed. This should be done each time the gun voltage is changed manually using the + and – buttons. The lens is degaussed automatically when a radio button is used to change the gun voltage. To set a specific working distance degauss the final lens and set the working distance with either the focus control or by left (or right) clicking on the working distance label control and setting the desired working distance. Then use the Z motion on the stage to focus the image.
- Tilt Focus — Is used to turn tilt focus on or off or to open a Tilt Focus form which is used to setup the amount of focus compensation. Tilt focus Is used to keep the image in focus from top to bottom when the stage is at a high tilt setting. Once the amount of compensation is set using the Tilt Focus form, the form can be closed and setting is saved. When tilt focus is turn on and off the saved setting is used.
- Invert Video — Is used to select between normal video or inverted. The video signal is inverted when On is selected.
- Chamber View — When clicked the SEM image will be replaced with the image from the chamber view. If no image appears make sure the chamber view power is turned on. Clicking again toggles the image back to the SEM image.
- Auto Video — Is used to turn automatic contrast and brightness (ACB) on or off. When turned on the SEM will analyze the image and automatically adjust the contrast and brightness. In this mode the Contrast and Brightness adjustment controls act as taste parameters allowing the user to adjust the automatic contrast and brightness set point.
- Erase SEM Annotation — Clicking the Erase SEM Annotation menu item will send a command to the SEM to erase all annotation and graphics. At times the SEM annotation or graphics may appear on the displayed image. This can occur if the SEM electronics console is turned off and then back on or during SEM calibration.
- TV Rate — On systems that have integrated TV rate clicking this item will turn on TV rate. In TV rate the sample is scanned at 30 frames per second. This may be useful on samples that are non conductive to reduce sample charging. This item will have a check mark next to it when TV rate is on and Line Scan, Spot Mode, Dual Magnification and Split Screen modes will be disabled.
- Line Scan — Activating line scan freezes the image then scans the sample along a single line. A reference line is drawn on the displayed image where the beam is scanning the sample. The signal from the active detector is displayed as a line across the image which is modulated by the variations in the signal level.

  The reference line can be moved by hovering the cursor over the line until the cursor changes to a four headed arrow. Then left click and drag the line to a new area. When the mouse button is released the reference line will move to the new area.

  The line can be scanned at slow scan rates 1 through 5 in line scan mode. Freeze the image to make measurements or to add text or symbols to the acquired image. This item will have a check mark next to it when line scan is on and TV Rate, Spot Mode, Dual Magnification and Split Screen modes will be disabled.

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- Spot Mode — When clicked the image is frozen and a cross hair is placed on the image. The electron beam strikes the sample without scanning at the point where the cross hair is located. The cross hair can be moved by hovering over the cross hair until the mouse cursor changes to a 4 headed arrow. When this occurs left click on the cross hair and drag it to a new location. The beam will strike the sample at the new location when the mouse button is released. Spot mode is usually used in conjunction with X-Ray analysis.

  This item will have a check mark next to it when it in spot mode and TV Rate, Line Scan, Split Screen and Dual Magnification modes will be disabled.

- Dual Magnification — Clicking the Dual Magnification menu item displays two side by side images. The image on the left is at a lower magnification and has a rectangle drawn on it. The area inside this rectangle is displayed on the right side at a higher magnification.

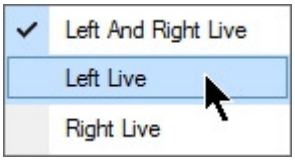
  The rectangle on the left can be moved by hovering the mouse over the rectangle until the cursor changes to a four headed arrow, then left click and drag the rectangle to a new area. The new area will be scanned once the mouse button is released.

  The rectangle on the left can be re-sized by hovering over the lower right corner of the rectangle until the cursor changes to a north-west / south-east arrow, then left click and drag the rectangle to re-size it. When the mouse button is released the new area will be scanned. Re-sizing the rectangle changes the magnification of the image displayed on the right. The magnification for each side is displayed on the bottom left and bottom right side of the alphanumeric. See section 3.2 (Tools > Customize) for displaying the alphanumeric.

  Dual magnification images can be acquired in rapid scan or slow scan. Freeze the image to make measurements or to add text or symbols to the acquired image. This item will have a check mark next to it when dual magnification is on and TV Rate, Line Scan, Spot Mode and Split Screen modes will be disabled.

- Split Screen — When activated the center section of the current image is scanned twice during each scan line. This is displayed on the screen as two side by side images. This mode is usually used to display a side by side comparison of the secondary electron detector signal and an auxiliary video signal such as a backscatter detector.

  Split screen can be activated by selecting SEM > Split Screen and selecting the desired mode on the fly-out. If a mode is active it will have a check mark next to it. Clicking on a mode with a check mark next to it will deactivate split screen mode. The signal displayed on the live side of the image is selected using the SEM > Auxiliary Video menu item (or the Auxiliary Video tool bar button).



For example an image with the secondary electron detector signal on the left and a backscatter detector signal on the right can be obtained using the following method. With the secondary electron signal active select either SEM > Split Screen > Left And Right live or SEM > Split Screen > Left Live. Obtain the desired image for the left side and then select SEM > Split Screen > Right Live. Next activate the backscatter detector signal by selecting SEM > Auxiliary Video. Obtain the desired image on the right side and then click the freeze button.

Split screen images can be acquired in rapid scan or slow scan. The selected split screen mode will have a check mark next to it when in split screen mode and TV Rate, Line Scan, Spot Mode and Dual Magnification modes will be disabled.

- Auxiliary Video — Allows the input channel to be switched between the SED (secondary electron detector) video signal and an auxiliary video signal. The auxiliary channel enables devices such as backscatter electron detectors (BSE) to be displayed using the SEM Interface software.

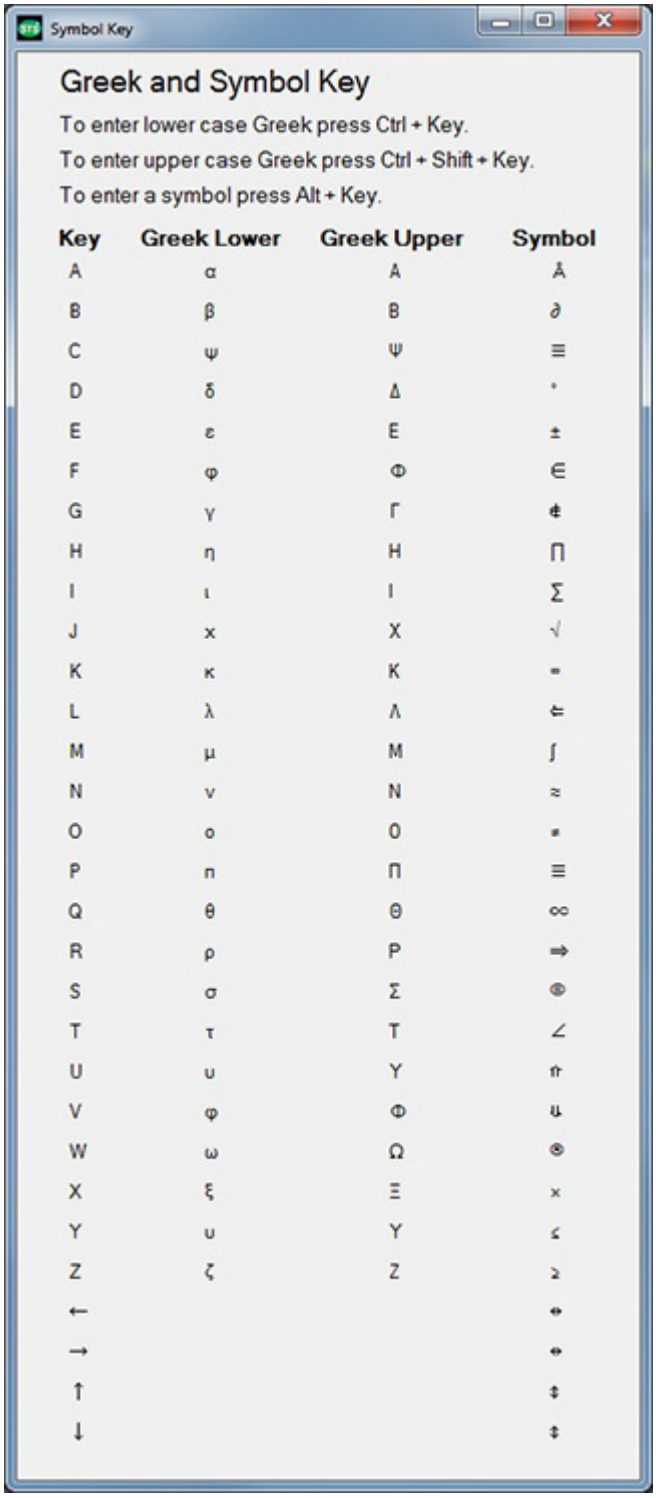
  This menu item will have a check mark next to it when the auxiliary video channel is the active channel. Clicking this item again toggles the active channel back to the SED video signal.

  Note: The Auxiliary Video channel will only be present when the wiring modifications have be performed after a software license has been purchased.

3.4 Help Menu

- User's Manual — When clicked it will open this document. If the document cannot be found a file open dialog will open so that the document can be located and opened.
- Gun Log — When clicked it will open the gun log file if one has been setup for the system.
- Symbol Table — See the next page for details.
- About — Opens the About form which displays the current version of the SEM Interface software and the serial number. It also shows how may days are remaining on the trial version if it is not a register version. If it is a registered version it will report that it is a Registered Version.

- Symbol Table — When clicked it will open a Symbol Key that shows the various Greek letters and symbols that are available for use when entering user text (see section 2.6 Insert Text or Symbols).


Symbol Key
Greek and Symbol Key
To enter lower case Greek press Ctrl + Key.
To enter upper case Greek press Ctrl + Shift + Key.
To enter a symbol press Alt + Key.
Key Greek Lower Greek Upper Symbol
A α Α Å
B β Β ∂
C ψ Ψ ≡
D δ Δ ◦
E ε Ε ±
F φ Φ ∈
G γ Γ ∉
H η Η ∏
I ι Ι Σ
J x Χ √
K κ Κ ▪
L λ Λ ⇐
M μ Μ ∫
N ν Ν ≈
O ο Ο ▫
P π Π ≡
Q θ Θ ∞
R ρ Ρ ⇒
S σ Σ ⊕
T τ Τ ∠
U υ Υ ⇑
V φ Φ ⇓
W ω Ω ⊗
X ξ Ξ ×
Y υ Υ ≤
Z ζ Ζ ≥
← ⇔
→ ⇔
↑ ⇕
↓ ⇕

To enter a Greek letter or symbol left click on the Insert Text or Symbols tool bar button. Left click on the image where the text is to be positioned. Find the Greek letter or symbol on the Symbol Key form. Move horizontally across the table to the left to the Key column. Use the letter in the Key column in combination with the control keys to enter the character.

For lower case Greek hold down the Ctrl key and press the letter in the Key column.

For upper case Greek hold down the Ctrl and Shift keys and press the letter in the Key column.

For a symbol hold down the Alt key and press the letter in the Key column.

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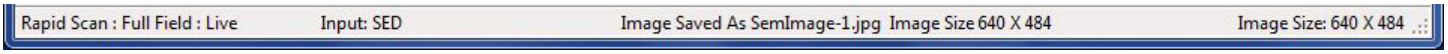
3.5 Status Strip

The status strip displays the current conditions of the SEM scanning mode, the input video source, the last saved image file name and the size it was saved at and the size of the image being displayed.



The following information is available on the status strip (in order from left to right).

Scan Rate : Scan Format : Freeze State Input Source Last Saved Image Name and Size Current Image Size

The following Scan Rates may be displayed:

- Rapid Scan
- Scan Rate 1
- Scan Rate 2
- Scan Rate 3
- Scan Rate 4
- Scan Rate 5

The following Scan Formats may be displayed:

- Full Field
- Partial Field
- Split Screen
- Dual Mag
- Line Scan
- Spot Mode

The following Freeze States may be displayed:

- Live
- Freezing
- Frozen
- Unfreezing

The following Input Sources may be displayed:

- SED (secondary electron detector)
- AUX (auxiliary video source)

The Last Saved Image Name is user defined and the saved image Size is dependent on the frame grabber type and the scan rate that was used when the image was acquired.

The Current Image Size is determined by the type of frame grabber installed in the PC and the current scan rate.

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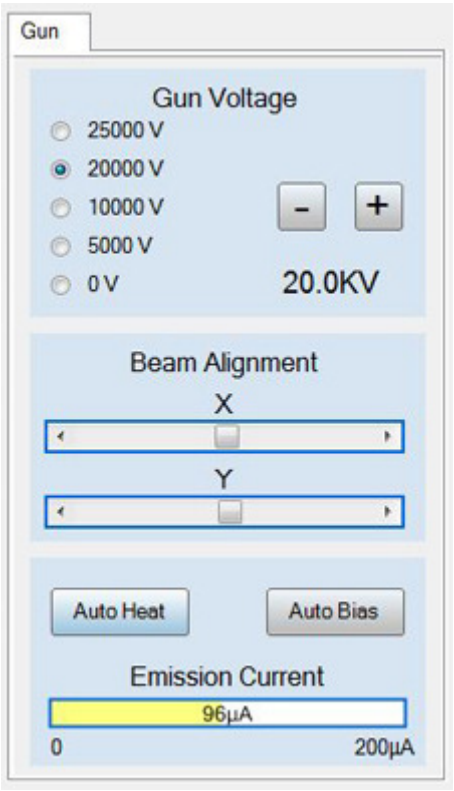
Chapter 4. Tabs

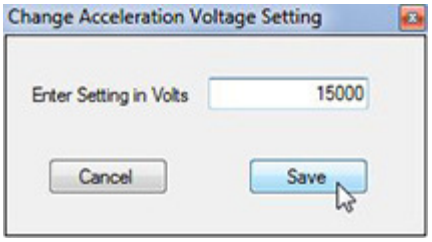
Depending on the system configuration one or more Tabs will be present on the right side of the image. If more tabs are available than can de displayed across the top of the tab selector, left and right arrows will appear on the right side of the tab selector. Use the arrows to scroll through the available tabs.

4.1 Gun Tab

The gun tab is used to adjust parameters that effect the electron beam. Depending on the system configuration the gun tab will appear differently.



All systems have a Gun Voltage section. Click on a radio button to select the desired beam voltage. Once clicked the beam voltage will be set and the final lens will be degaussed. To change one of the settings for a radio button right click on the voltage setting label. This will open a dialog that enables the setting to be changed. Enter the new setting then click the Save button. The new setting is saved and will become the default value. The gun voltage can be change by clicking on the + (plus) and — (minus) buttons. Left clicking on one of the buttons changes the voltage in 100V steps, right clicking changes the voltage in 1000V steps.



The beam alignment scroll bars are used to electronically alter the path of the electron beam as it moves through the column. Adjust the scroll bars to optimize the brightness of the image. This should be performed at a low magnification. Use the scroll box in the center of the scroll bar for coarse adjustment. Click between the scroll box and one of the arrows for a medium adjustment and use the arrows on the ends of the bar for fine adjustments.

Note: Beam Alignment will only be present on thermionic systems when the wiring modifications have be performed after a software license has been purchased.

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Auto heat and auto bias are used on thermionic systems. Clicking auto heat slowly ramps the filament current to a preset value. While the current is ramping the Auto Heat button will flash, once the current is at its set point the button will stop flashing and be tinted blue. Clicking the Auto Bias button will adjust the gun bias to obtain a preset emission current setting. The Emission Current meter displays the amount of emission current emitted by the electron gun.

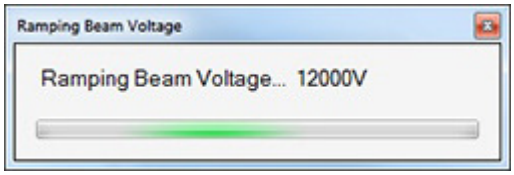
Note: The Emission Current meter will only be present on thermionic systems when the wiring modifications have be performed after a software license has been purchased.

On field emission systems the auto heat and bias section is replaced with a Status section. The status section shows the current gun mode, the gun vacuum and the column vacuum.

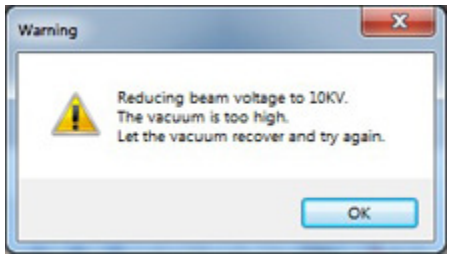
4.1.1 Field Emission Gun Voltage

On field emission systems the preferred method of changing the gun voltage is to use the radio button controls. When a radio button is used to change the gun voltage automatic beam voltage ramping and vacuum monitoring (enabled by default) occurs. The purpose of this is to prevent a gun arc which could permanently damage the electron gun.

When a gun voltage is selected that is above 10000V by clicking one of the radio buttons, the gun vacuum is recorded then the voltage is immediately set to 10000V. A delay occurs then another vacuum reading is taken. If the vacuum has increased with respect to the initial reading then another longer delay occurs before another gun vacuum reading is taken. If it is determined that the vacuum has stabilized then the voltage will be increased by 1000V. Another delay occurs and the process of monitoring the vacuum, waiting for it to stabilize and increasing the voltage is repeated until the selected gun voltage setting is reached. During this process a wait window like the one shown on the left will be displayed. To cancel the process click on a radio button with a voltage setting of 10000V or less or click the beam voltage minus (—) button. If at any time during this process the gun vacuum rises to 100nA or above the gun voltage is reduced to 10000V, a message is displayed and the operation is aborted.

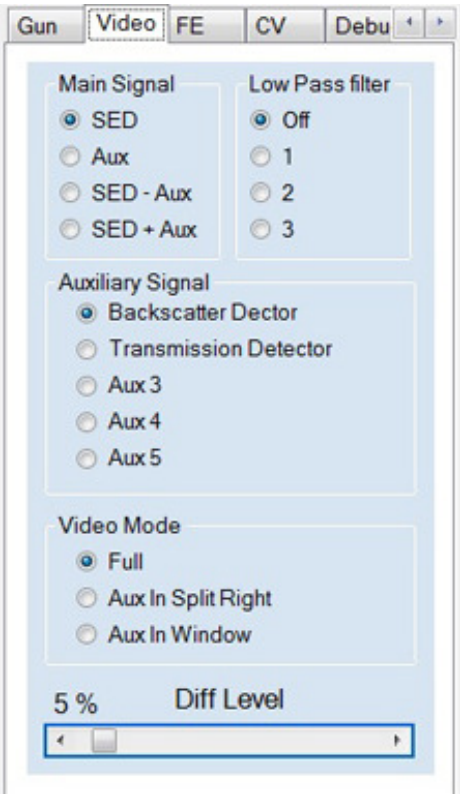


Another feature of field emission systems is active gun vacuum monitoring (enabled by default). When the gun voltage is above 10000V the gun vacuum is monitored. If the vacuum increases to 100nA or above the gun voltage is reduced to 10000V and a warning message is displayed.



4.2 Video Tab

The Video tab is available on 3xxx series instruments.



The Main Signal section works in conjunction with the Auxiliary Signal section to determine the image source to display.

SED — When selected the secondary electron detector is the primary signal source.

Aux — When selected the selected Auxiliary Signal is the primary signal source.

SED - Aux — When selected the signal form the selected Auxiliary Signal source is subtracted from the secondary electron detector signal and becomes the primary signal source.

SED + Aux — When selected the signal form the selected Auxiliary Signal source is added to the secondary electron detector signal and becomes the primary signal source.

The Video Mode determines how the image will be displayed.

Full — The primary signal source is displayed as a full frame.

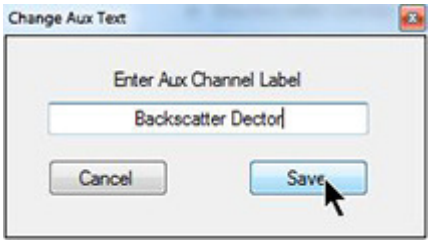
Aux In Split Right — The display is split down the middle vertically and the primary signal source is displayed on the left and the selected Auxiliary Signal source is displayed on the right.

Aux In Window — The primary signal source is displayed as a full frame with a window drawn over it. The selected Auxiliary Signal source is displayed inside the window.

The Low Pass Filter is used in slow scan to filter noise on the video signal. When in slow scan select the amount of filtering to apply to the video signal. The higher the number the lower the cutoff frequency of the filter (a higher number applies more filtering to the signal).

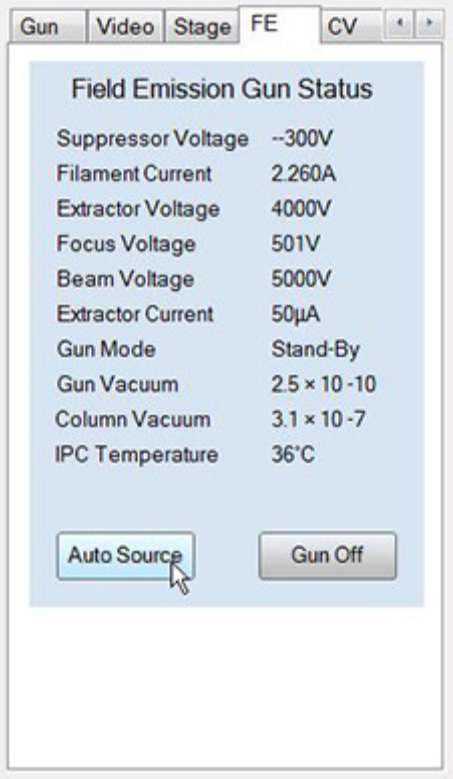
Diff Level — Is used to enhance the edges of a video signal in slow scan. The areas of the image where there is a rapid transition from black to white (or white to black) will be enhanced. While in slow scan use the scroll bar to set the amount of enhancement to be applied to the video signal.

To change a label to a meaningful name for an Auxiliary Signal channel right click on the label. A dialog will open that enables the name to be changed. Enter the desired name in the Enter Aux Channel Label text box and click the Save button.



4.3 FE Tab (Field Emission)

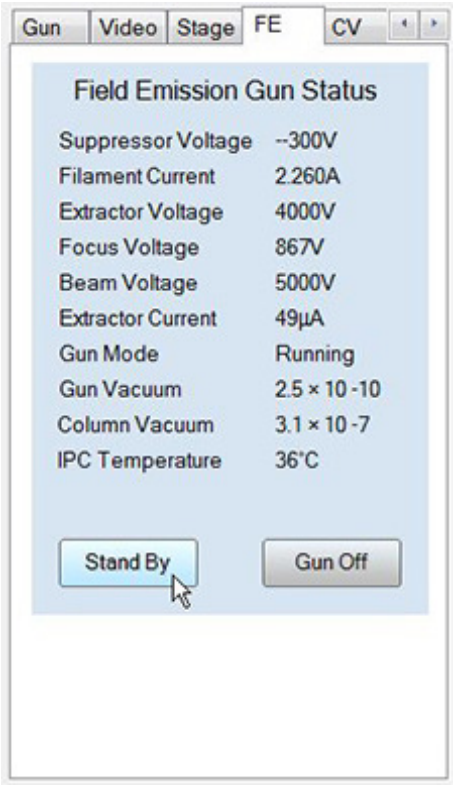
The FE tab is available on systems that have a field emission gun.



The top part of the tab shows the current status of the field emission gun. The settings are configured by SEMTech service engineers are not user configurable.

Auto Source / Stand By button — When the gun mode is Stand-By or Off clicking on the Auto Source button will ramp the gun parameters to the Running mode. It will take longer for the gun to reach the Running mode if the gun is Off when the Auto Source button is clicked.

When the Gun Mode is Running the text on the button will change to Stand By as shown on the right. Clicking the Stand By button will put the field emission gun in stand by mode. The gun should be put in Stand By mode if it is not going to be used for several hours.



Gun Off — Clicking the Gun Off button will turn the field emission gun off.

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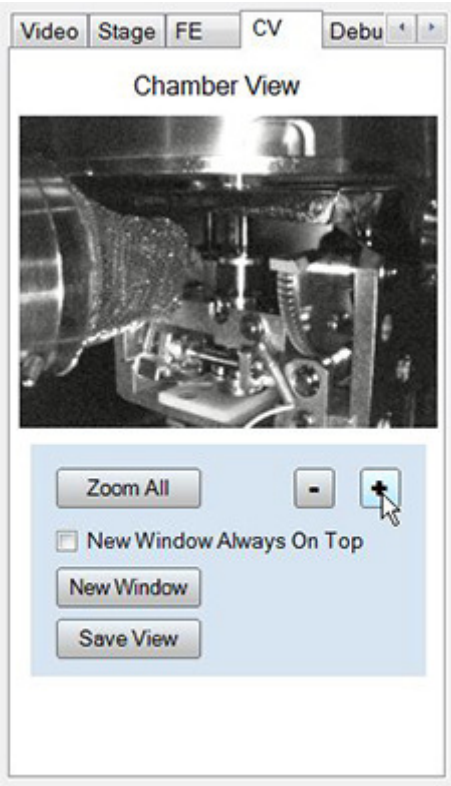
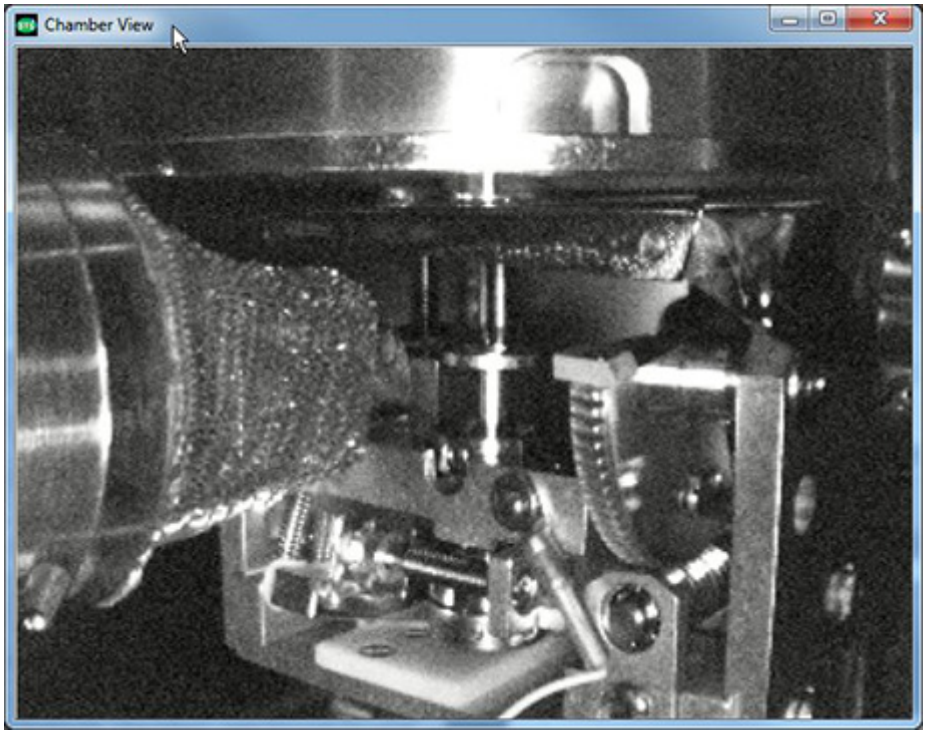
4.4 Chamber View Tab

On systems that use the DVI2PCIe frame grabber and are equipped with a SEMTech Solutions Chamber View, the Chamber View tab will be available.



The + and - buttons cause the chamber view image on the tab to be zoomed in or out. The Zoom All button zooms to the widest field of view setting.

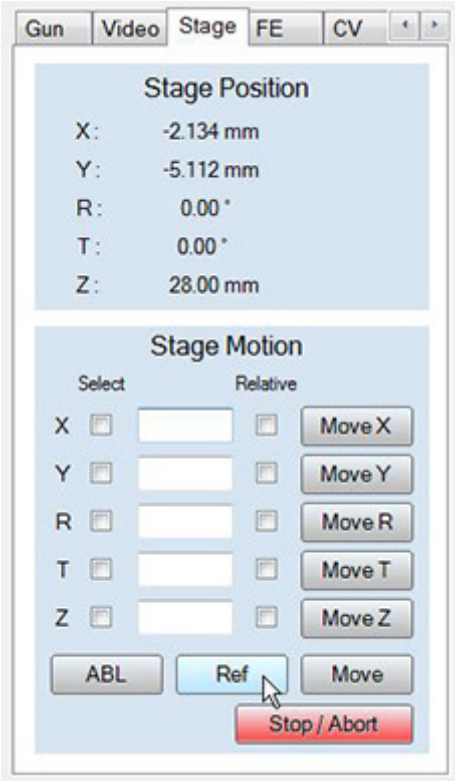
The New Window Button causes a new window to open containing a full field view of the chamber view image as shown below. The window can be expanded or shrunk as desired and the image will maintain its aspect ratio. If the New Window Always On Top check box was checked before the New Window button was clicked, the Chamber View window will always be the foreground window on top of other windows.



Clicking the Save View button opens a Save As dialog that enables the chamber view image to be saved.

4.5 Stage Tab

The Stage tab is available on systems with a motorized stage.



The Stage Position section on the top of the tab displays the current position of the stage. If it is not a five axis stage only the installed axes will be displayed.

The Stage Motion section can be used to move the stage. Before using the stage it must be referenced. Click the Ref button to reference the stage.

The stage can be moved one axis at a time by clicking the Move X, Move Y, Move R, Move T or Move Z buttons. Enter a position in the text box on the row for the axis that is to be moved and click on the Move (X, Y, R, T or Z) button on the right side of the row. Once the button is clicked the stage will move to the position in the text box.

Multiple axes can be moved at once by entering a value in the text box on the axis row. Click on the Select check box for the rows that are to be moved and click on the Move button just above the Stop / Abort button. When the Move button is clicked any row that has its Select check box checked will be moved.

An axis can be move a relative distance by checking the Relative check box for an axis. Enter a value in the text box for a row and check the Relative check box. When the axis is moved by clicking on one of the move buttons it will move the distance in the text box relative to the position that it is currently at. Entering a negative number when the Relative check box is selected will cause the value in the text box to be subtracted from the current position.

The ABL button will cause the stage to perform an anti-backlash function. This may increase the accuracy of the stage positioning.

Clicking the Stop / Abort button will immediately stop all axes.

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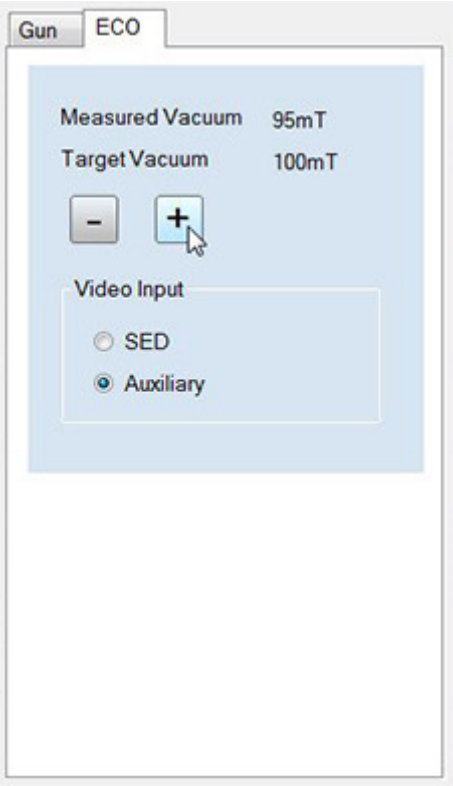
4.6 ECO Tab

The ECO tab (Environmentally Controlled SEM) is available on systems that can operate in ECO SEM mode.



The vacuum system must be put into ECO mode. Once in ECO mode select the Auxiliary radio button to enable a video source such as a backscatter detector. The SED (secondary electron detector) cannot be used in ECO mode.

Use the + and - buttons to set the Target Vacuum. The actual Measured Vacuum will be displayed to the right of the Measured Vacuum label.

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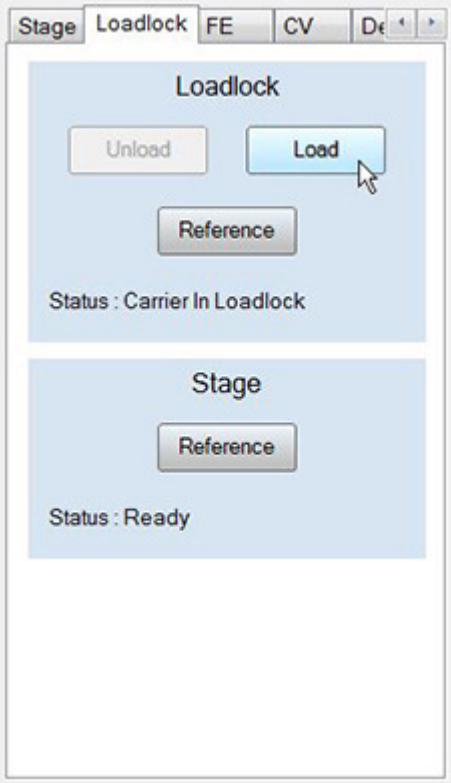
4.7 Loadlock Tab

The Loadlock tab is available on systems equipped with a Loadlock. There are two sections associated with the loadlock tab; the Loadlock and the Stage sections.



The stage section provides a convenient way to Reference the stage if it is not in the Ready state. A transfer can only be made when the stage status is in the Ready state. If it is not in the Ready state click the Reference button in the Stage section to reference the stage which will put it in the Ready state once a stage reference is complete.

The loadlock section provides three buttons used to control the loadlock. Depending on the status of the loadlock and the carrier one or more of the buttons may be disabled indicating that its function is not available.

To load a carrier onto the stage open the loadlock drawer and place the carrier on the loadlock transfer arm. Close the drawer and click the Load button. The loadlock will pump down and the stage will move to the load position. When the loadlock is pumped down the gate valve will open and the transfer arm will move the carrier onto the stage and then retract. The gate valve will close once the transfer arm is fully retracted. The Load button will blink while a transfer is in progress.

To unload a carrier that is on the stage click the Unload button. The loadlock will pump down and the stage will move to the load position. When the loadlock is pumped down the gate valve will open and the transfer arm will move in and remove the carrier from the stage and then retract. The gate valve will close once the transfer arm is fully retracted and the loadlock chamber will vent. The Unload button will blink while a transfer is in progress.

Pressing the Reference button (in the Loadlock section) moves the transfer arm to the home position and vents the loadlock chamber. It may be necessary to reference the loadlock if the transfer arm is moved during a sample exchange.